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TWENTY-FIRST REGULAR SESSION

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Report of the 25th Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

WCPFC-NC21-2025/IP-01

ISC[1]

[1] International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

REPORT OF THE TWENTY-FIFTH MEETING OF THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

PLENARY SESSION

17-20 June 2025
Busan, Republic of Korea

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PLENARY SESSION

17-20 June 2025

Highlights of the ISC25 Plenary Meeting

The 25th ISC Plenary session was held in-person in Busan, Republic of Korea, June 17-20, 2025. The meeting was attended by members from Canada, Chinese Taipei, Japan, Republic of Korea, Mexico and the United States as well as a representative from the Western and Central Pacific Fisheries Commission (WCPFC). Observers from The Ocean Foundation, Monterey Bay Aquarium, Accountability.Fish, and the World Wide Fund for Nature Japan, also attended the ISC25 Plenary session.

While no new benchmark stock assessments were completed in 2024, the Committee made significant progress on management strategy evaluation, harvest strategy implementation, and stock indicator updates.

The Albacore Working Group (ALBWG) corrected minor errors in the 2023 benchmark stock assessment and confirmed that the revised estimates do not change the previous stock status determination. In response to NC and IATTC requests, the ALBWG conducted detailed analyses linking fleet-specific spawning potential ratios (SPR) to catch and effort metrics for Japanese longline fleets targeting North Pacific albacore. Results indicated that changes in catch can be used to infer changes in SPR, but relationships with effort are more variable and fleet-specific. The ALBWG emphasized that before fishing intensity targets can be translated into national measures, RFMOs must allocate allowable fishing intensity among fleets. The group also reiterated the need for periodic review of SPR relationships, particularly if reference points are breached or exceptional circumstances are triggered.

The Pacific Bluefin Tuna Working Group (PBFWG) completed an extensive Management Strategy Evaluation (MSE) to support NC's adoption of a long-term harvest strategy. Sixteen candidate harvest control rules (HCRs) were tested across a range of productivity scenarios. These results provide the scientific foundation for RFMO deliberations at the 2025 IATTC–WCPFC–NC Joint Working Group meeting. The ISC stressed that management objectives must be clearly articulated to guide the selection of an HCR consistent with rebuilding, economic, and distributional goals.

The Billfish Working Group responded to a 2024 peer review of the Western and Central North Pacific striped marlin stock assessment and conducted additional rebuilding analyses aligned with the new WCPFC CMM 2024-06. Projections indicate that revised catch limits could improve the likelihood of achieving rebuilding targets. For blue shark, the Shark Working Group concluded that recent indicator trends do not warrant an earlier benchmark assessment; the next assessment remains scheduled for 2027.

Across working groups, ISC25 continued work on incorporating climate change considerations into stock assessments and management advice, as requested by NC19. A climate impact matrix was developed, but progress was uneven, and the ISC noted that significant analytical work and coordination across institutions will be required before climate impacts can be robustly integrated into advice.

Finally, ISC25 emphasized the need to review ISC operating structure to ensure sustained delivery of transparent and relevant science. As the NC continues to implement harvest strategies and refine management frameworks, the ISC remains committed to supporting these efforts through best-available science, improved documentation, and responsive analytical work.

The next Plenary meeting will be hosted by Chinese Taipei and is tentatively planned for June 22-29, 2026, at a location and venue to be determined in Chinese-Taipei.

ISC25 Group, Busan, Republic of Korea, June 20, 2025

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ACRONYMS AND ABBREVIATIONS

Names and FAO Codes of ISC Species of Interest in the North Pacific Ocean

FAO Code	Common English Name	Scientific Name
	TUNAS	
ALB	Albacore	*Thunnus alalunga*
BET	Bigeye tuna	*Thunnus obesus*
PBF	Pacific bluefin tuna	*Thunnus orientalis*
SKJ	Skipjack tuna	*Katsuwonus pelamis*
YFT	Yellowfin tuna	*Thunnus albacares*
	BILLFISHES	
BIL	Other billfish	Family *Istiophoridae*
BLM	Black marlin	*Makaira indica*
BUM	Blue marlin	*Makaira nigricans*
MLS	Striped marlin	*Kajikia audax*
SFA	Sailfish	*Istiophorus platypterus*
SSP	Shortbill spearfish	*Tetrapturus angustirostris*
SWO	Swordfish	*Xiphias gladius*
	SHARKS	
ALV	Common thresher shark	*Alopias vulpinus*
BSH	Blue shark	*Prionace glauca*
BTH	Bigeye thresher shark	*Alopias superciliosus*
FAL	Silky shark	*Carcharhinus falciformis*
LMA	Longfin mako	*Isurus paucus*
LMD	Salmon shark	*Lamna ditropis*
OCS	Oceanic whitetip shark	*Carcharhinus longimanus*
PSK	Crocodile shark	*Pseudocarcharias kamonharai*
PTH	Pelagic thresher shark	*Alopias pelagicus*
SMA	Shortfin mako shark	*Isurus oxyrinchus*
SPN	Hammerhead spp.	*Sphyrna* spp.

ISC Working Groups

Acronym	Name	Chair
ALBWG	Albacore Working Group	Sarah Hawkshaw (Canada)
BILLWG	Billfish Working Group	Michelle Sculley (U.S.A.)
PBFWG	Pacific Bluefin Working Group	Shuya Nakatsuka (Japan)
SHARKWG	Shark Working Group	Michael Kinney (U.S.A.)
STATWG	Statistics Working Group	Jenny Suter (U.S.A)

Other Abbreviations and Acronyms that may be Used in the Report

CDS	Catch documentation scheme
CIE	Center for Independent Experts
CKMR	Close-kin mark-recapture
CMM	Conservation and Management Measure
CPFV	Charter passenger fishing vessel
CPUE	Catch-per-unit-of-effort
CSIRO	Commonwealth Scientific and Industrial Research Organization
DWLL	Distant water longline
DWPS	Distant-water purse seine
EEZ	Exclusive economic zone
EPO	Eastern Pacific Ocean
F	Fishing mortality rate
FAD	Fish aggregation device
FAO	Fisheries and Agriculture Organization of the United Nations
FL	Fork length
HCR	Harvest control rule
HMS	Highly migratory species
H_{MSY}	Harvest rate at MSY
IATTC	Inter-American Tropical Tuna Commission
ISC	International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean
ISSF	International Seafood Sustainability Foundation
LFSR	Low fecundity spawner recruitment relationship
LTLL	Large-scale tuna longline
LRP	Limit reference point
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
NC	Northern Committee (WCPFC)
NRIFSF	National Research Institute of Far Seas Fisheries (Japan)
OFDC	Overseas Fisheries Development Council (Chinese Taipei)
PICES	North Pacific Marine Science Organization
PIFSC	Pacific Islands Fisheries Science Center (U.S.A.)
SAC	Scientific Advisory Committee (IATTC)
SC	Scientific Committee (WCPFC)
SG-SCISC	Study Group on Scientific Cooperation of ISC and PICES
SPC-OFP	Oceanic Fisheries Programme, Secretariat of the Pacific Community
SPR	Spawning potential ratio, spawner per recruit
SSB	Spawning stock biomass
$SSB_{F=0}$	Spawning stock biomass at a hypothetical unfished level
$SSB_{CURRENT}$	Current spawning stock biomass
SSB_{MSY}	Spawning stock biomass at maximum sustainable yield
STLL	Small-scale tuna longline

t, mt	Metric tons, tonnes
WCNPO	Western Central and North Pacific Ocean
WCPFC	Western and Central Pacific Fisheries Commission
WPO	Western Pacific Ocean
WWF	World Wildlife Fund for Nature - Japan
GRT	Gross registered tons

1 INTRODUCTION AND OPENING OF THE MEETING

1.1 Introduction

The ISC was established in 1995 through an intergovernmental agreement between Japan and the United States (U.S.A.). Since its establishment and first meeting in 1996, the ISC has undergone a number of changes to its charter and name (from the Interim Scientific Committee to the International Scientific Committee) and has adopted a number of guidelines for its operations. The two main goals of the ISC are (1) to enhance scientific research and cooperation for conservation and rational utilization of the species of tuna and tuna-like fishes that inhabit the North Pacific Ocean during a part or all of their life cycle; and (2) to establish the scientific groundwork for the conservation and rational utilization of these species in this region. The ISC is made up of voting members from coastal states and fishing entities of the region as well as coastal states and fishing entities with vessels fishing for highly migratory species in the region, and non-voting members from relevant intergovernmental fishery and marine science organizations, recognized by all voting members.

The ISC provides scientific advice on the stocks and fisheries of tuna and tuna-like species in the North Pacific Ocean (NPO) to the Member governments and regional fisheries management organizations. Fishery data tabulated by ISC members and peer-reviewed by the species and statistics Working Groups (WGs) form the basis for research conducted by the ISC. Although some data for the most recent years are incomplete and provisional, the total catch of highly migratory species (HMS) by ISC members estimated from available information is more than 500,000 metric tons (t) annually and is dominated by tropical tuna species. Retained catches of priority NPO species monitored in 2024 by ISC members were 51,052 t of North Pacific albacore tuna (NPO ALB), 17,843 t of Pacific bluefin tuna (PBF), 8,073 t of North Pacific swordfish (SWO), 2,433 t of North Pacific striped marlin (MLS), 6,756 t of Pacific blue marlin (BUM), 1,082 t of North Pacific shortfin mako shark (SMA) and 36,039 t of North Pacific blue shark (BSH).[1] The total estimated retained catch of these seven species is 123,277 t, or approximately 110% of the 2023 total estimated catch of 111,597 t. Annual catches of priority stocks throughout their ranges reported by ISC members are shown in the catch tables at the end of this report.

1.2 Opening of the Meeting

The Twenty-fifth Plenary session of the ISC (ISC25) was convened in Busan, Republic of Korea at 9:00 a.m. on 17 June 2025 by the ISC Chair, R. Ahrens. Mr. Yong-seok Choi, President of the Korean National Institute of Fisheries Science, provided an opening statement, welcoming ISC members to Busan. A roll call confirmed the participation of delegates from Canada, Chinese Taipei, Japan, Republic of Korea, Mexico (via remote access), and U.S.A. Representatives from the Western and Central Pacific Fisheries Commission (WCPFC) Secretariat and the North Pacific Marine Science Organization (PICES) were also present. Representatives from

[1] FAO three-letter species codes are used throughout this report interchangeably with common names.

Accountability.Fish, The Ocean Foundation, Monterey Bay Aquarium and World Wide Fund for Nature-Japan were present as observers (**ISC/25/ANNEX/01**).

ISC Member China, as well as the non-voting members, the Fisheries and Agriculture Organization of the United Nations (FAO), and Secretariat of the Pacific Community (SPC), while extended an invitation, did not attend the Plenary.

2 ADOPTION OF AGENDA

A list of meeting documents is contained in **ISC/25/ANNEX/02**. The proposed agenda for the session (**ISC/25/ANNEX/03**) was considered and adopted. Emily Crigler (USA) was assigned lead rapporteur duties.

A list of common abbreviations and acronyms used by the ISC is provided in the preface to this report.

3 DELEGATION REPORTS ON FISHERY MONITORING, DATA COLLECTION AND RESEARCH

3.1 Canada

S. Hawkshaw presented the Canada National Report **(ISC/25/PLENARY/04)**. Canada has one commercial fishery for highly migratory species in the Pacific Ocean, a troll fishery targeting juvenile north Pacific albacore tuna (*Thunnus alalunga*). Category I, II, and III data submitted to the ISC for the 2024 fishing season are summarized in this report. The Canadian fleet consisted of 100 vessels and operated only within the eastern Pacific Ocean, in 2024. No vessels from the Canadian fleet operated in the central and western Pacific Ocean in 2024. The Canadian troll fishery continues to be largely coastal in operation, occurring predominantly within the Canadian and United States (US) exclusive economic zones (EEZ). Only a small proportion of the catch and effort in 2024 occurred outside the Canadian and US EEZs, in high seas waters. The provisional 2024 estimates of total catch and effort in the eastern Pacific Ocean are 2,888 metric tonnes (t) and 3,618 vessel-days (v-d), respectively. This represents a 151% increase in catch and a 71% increase in effort relative to 2023, which was the lowest in the timeseries. The catch and effort in the Canadian EEZ in 2024 increased by 109% and 41%, respectively, relative to 2023. The catch and effort in the US EEZ in 2024 were similar to levels last seen in 2021. The remaining catch and effort occurred in adjacent high seas waters, which decreased relative to 2023. The overall catch rate or catch per unit effort (CPUE) increased from 0.54 t/v-d in 2023 to 0.8 t/v-d in 2024 and was highest in the Canadian EEZ in July. Approximately 81% of the Albacore catch occurred in the favorable water temperature band of 16-19 °C in 2024. Forty-one (41) vessels measured 12,471 fork lengths in 2024 for a sampling rate of 2.5% of the overall reported catch. Fork lengths ranged from 51 to 96 cm, having a mode at 67 cm corresponding to 2-year old fish. Mean length was 67.2 cm, which is similar to previous years. Canada is continuing to monitor the activity of a small recreational fishery targeting albacore tuna that has been developing in Canadian waters over the last several years. The impact from this fishery, however does not appear to be significant and these data are not included in this report.

Discussion

The Plenary discussed the decreasing trend in the number of active Canadian troll vessels in the time series, particularly the large decrease seen between 2022 and 2023. Canada explained that the decrease in participation in the 2023 fishery could be due to a number of factors, including increased fuel prices, poorer market conditions, and no fishing in the United States in the absence of agreement on a fishing regime in 2023 under the bi-lateral Canada-United States Albacore Tuna Treaty. Canada also reminded the plenary that the majority of the Canadian tuna fleet also participates in a number of other domestic fisheries, such as groundfish and salmon and that their participation in the tuna fishery can be influenced by the annual conditions in these other fisheries. Canada also reported an increase in Pacific bluefin tuna bycatch to 14 juvenile fish (approximately 0.1 t) in 2024. This was the highest number recorded in the time series, however in 2021 8 PBF were reported and 9 PBF in 2014 and 2009. This raised questions about the need for further discussion on how to report bycatch data in the ISC, particularly for species which are assessed. **ISC25 agreed to have further discussions on how to report bycatch data and how to better integrate that data into stock assessments in the future.**

3.2 Chinese Taipei

Y.-J. Chang presented the Chinese Taipei national report (**ISC/25/PLENARY/05**). Taiwanese tuna fisheries in the North Pacific Ocean mainly comprise tuna longline and tuna purse seine fisheries, and other small-scale fisheries operating off waters of Taiwan, such as harpoon, set net, and gill net. More than 90 percent of tuna and tuna-like species catch of Taiwanese fisheries in the North Pacific Ocean are from tuna longline and purse seine fisheries. The tuna longline fisheries consist of large-scale tuna longline vessels and small-scale tuna longline vessels. The number of fishing vessels of these two fisheries were 69 and 852, and the catches of tuna and tuna-like species catches in the North Pacific Ocean were 6,783 t and 25,307 tons in 2024, respectively. For the tuna purse seine fishery, the number of fishing vessels was 24 with a catch of 228,956 tons in the Pacific Ocean in 2024. Fifty-one observers were deployed on tuna longline vessels operating in the Pacific Ocean, including 15 on large-scale tuna longline vessels and 36 on small-scale ones in 2024 with two observers conducting 4 observation trips on a large-scale tuna longline and a small-scale tuna longline. Taiwanese scientists conducted nine scientific projects on the stock status of tuna and tuna-like species, and the impacts of mitigation measures on the bycatch species in the Pacific Ocean under funding support from the Taiwan Fisheries Agency in 2024.

Discussion

The Plenary discussed a recent increase in albacore tuna catch in the small tuna longline (STLL) fishery 2024. This may have been due to a combination of factors, including a shift in effort to regions south of 20°N (region 3 in the recent stock assessment), more stable albacore prices, which led fishers to prioritize it over other tuna species with more volatile prices, and an increase of vessel numbers as a result of shifting effort from the Indian Ocean. Due to the post COVID-19 recovery, there was also an increase in the availability of crew members, which allowed for more regular operations and likely contributed to higher catch. The number of length frequency observations for albacore in the STLL fishery was low because the port sampling is based on albacore catches from coastal and offshore waters around Chinese Taipei.

3.3 Japan

H. Kiyofuji presented the Japan National Report (**ISC/25/PLENARY/06**). Japanese tuna fisheries consist of three major fleets (longline, purse seine, and pole-and-line), as well as other fisheries including troll, driftnet, and set-net fisheries. The number of active longline vessels in the NPO has a declining trend in all size categories, falling to 245 vessels in 2024 - almost half of the number active in 2006. The number of purse seiners has remained stable at around 70. The number of pole and line vessels in the over 50 GRT size category has declined, with only 55 active vessels in 2024, less than half of the active vessels in 2006. There was no significant difference in the distribution of fishing effort between 2023 and 2024 in the three main fisheries. The total catch of tuna excluding skipjack caught by Japanese fisheries in the NPO was 85,423 t in 2023 and 79,769 t in 2024. The total catch of tunas including SKJ caught by Japanese fisheries in the NPO was 226,155 t in 2023 and 264,148 t in 2024. The total catch of SWO and MLS was 6,023 t in 2023 and 6,432 t in 2024. In addition to these descriptions of the fisheries, the Japan National Report briefly outlines Japanese research activities on tuna and tuna-like species in the Pacific Ocean in 2024. These activities include a larvae/juvenile research cruise, the spawning behavior of PBF captured during research cruise, a troll survey of age-0 PBF, technical development for close-kin-mark-recapture (CKMR) analysis of PBF, and the tagging of striped marlin, skipjack and albacore.

Discussion

The Plenary discussed ongoing efforts within ISC Working Groups to collaborate among members on aging, growth, and data validation efforts. Regarding a recent increase in catch of Pacific bluefin in southern waters, Japan acknowledged limited tag recoveries in New Zealand and Australia and noted that they will begin collecting that data when available. They also noted that the recovered tags have been conventional tags. There was a shift in the 2024 Pacific bluefin length-frequency data for longline, with an absence of the 90 cm fish seen in 2023, which was likely due to changes in fishing operations as the fishery transitions from total allowable catch to individual quota management. In response to a question regarding ecosystem status reports, Japan noted that any such reports are produced by the Ministry of the Environment and offered to locate and share relevant links.

3.4 Korea

H. Kim presented the Korea national report (**ISC/25/PLENARY/07**). Korean distant water tuna and tuna-like fisheries in the Pacific Ocean consist of both longline and purse seine fishery. There were 94 active longline vessels and 22 active purse seine vessels in 2024. The two types of Korean fisheries harvested 51,736 t of tuna and tuna-like species in the North Pacific Ocean in 2024. The total catch of the longline fishery was 23,866 t, a 30% increase over 2023, while the purse seine fishery harvested 27,870 t, a 72% rapid decrease year-to-year. The longline fishery mainly targeted yellowfin and bigeye tunas, whose catch accounted for 45.2% and 44.1% of the total catch in 2024. The dominant species of the purse seine fishery was skipjack tuna (96.9%), followed by yellowfin tuna (2.8%) and bigeye tuna (0.3%). Pacific bluefin tuna (PBF) is harvested by some coastal and offshore fisheries in the Korean waters. The offshore large purse seine fishery operates in the waters surrounding Jeju Island. In 2024, the PBF catch of the offshore purse seine fishery was 439 t, which accounted for 57.1% over the total catch. The PBF catch of the set net fishery was 307 t, which accounted for 39.9% over the total catch, and trawl fishery caught 23 t in 2024. In 2024, the catch of large PBF (30kg or greater) accounted for 55% of the total catch.

Discussion

The Plenary discussed shifts in tuna catch patterns, variability in PBF size data and biological research on PBF larvae. Members agreed on the value of strengthening research collaboration, particularly between Korea and Japan on PBF research through the ISC. Regarding CKMR methodology, Korea plans to adopt Japan's new standard starting next year, enabling joint research aligned with ISC goals. There was a sharp increase in yellowfin tuna catches in the Korean longline fishery in 2024, which may be attributed to a shift in fishing grounds, potentially influenced by climate variability.

3.5 Mexico

M. Dreyfus-Leon presented the Mexico National Report (ISC/25/PLENARY/08). Purse seine vessels get the majority of the Mexican tuna catch in the EPO. The fleet is quite stable, around 50 vessels in the past 15 years. The majority are 400 cubic meters or more and have all 100% observer coverage. Catch composition is about 80% YFT , followed by SKJ as complementary catch. The majority goes to canning.

PBF catch has been subject to catch quotas and is being monitored with observers on board all trips. All the PBF is transported alive to farming pens and size sampling is done with stereoscopic underwater cameras, information provided to scientists to generate size composition of the catch.

From that quota, also some artisanal vessels have been fishing PBF in very small quantities and the local government is monitoring the Mexican sport fishery since 2023.

Regarding Sharks, an update on Blue Shark up to 2023 catches is presented as well as area-catch information and a climate index correlation with CPUE for blue shark.

Management for tunas and sharks is according to IATTC regulations and for sharks there are also national regulations, most importantly a 3-month closure.

Discussion

Mexico confirmed that figures in the national report reflect catches from Mexico-based recreational vessels, not U.S.-based vessels operating in Mexican waters, which are managed and reported by the United States. Regarding a recent decline in reported recreational catches of Pacific bluefin tuna, Mexico explained that recreational fishing for Pacific bluefin is still developing, and the activity remains sporadic and not consistently targeted, which accounts for the fluctuations in catch levels. While the recent stock assessment shows that the Pacific bluefin stock is increasing, Mexico's catch figures have not shown significant growth. Mexico clarified that this is due to quota regulations, not stock availability. This year marks the first increase in

Mexico's catch quota, and the resulting increase in catches is expected to be reflected in next year's ISC report.

3.6 U.S.A.

K. Koch presented the U.S.A. National Report (**ISC/24/Plenary/09**). In 2024, U.S. fisheries that catch tuna and tuna-like species in the North Pacific Ocean exhibited mixed trends across sectors. The U.S. purse seine fleet remained small, with only 13 vessels active north of the equator in the WCPO, below the 5-year average of 22. Effort was concentrated between 170°E and 130°W, and all trips had 100% observer coverage. The longline fishery, particularly the Hawaii-based deep-set sector, remained the largest source of catch, with 149 vessels active (slightly above the 5-year average). Bigeye tuna dominated the longline catch (6,129t), though this was below the recent average, while swordfish catch (1,018 t) was near average. The albacore troll and pole-and-line fishery rebounded in 2024 with landings increasing to 4,697t (from 3,651 t in 2023). However, the high seas accounted for just 0.6% of the U.S. albacore troll and pole-and-line catch in 2024, a sharp decline from 20.6% the previous year. Small boat fisheries across Hawaii, Guam, and CNMI saw reduced activity and catch, with retained landings totaling 962 t, below the 5-year average of 1,275 t. Skipjack and yellowfin tuna made up the bulk of the troll catch, while handline landings were mostly yellowfin and bigeye. The drift gillnet fishery continued to phase out, with only four vessels and a swordfish catch of 24 t. The harpoon fishery remained small and declined slightly, with 19 t of swordfish landed. The deep-set buoy gear fishery also declined, with landings dropping from 31 t to 8 t and vessel participation falling from 21 to 13. In recreational fisheries, albacore tuna landings increased to 865 t, above average, while Pacific bluefin tuna landings held steady at 1,385 t. Overall, the U.S. HMS fisheries showed a continuation of long-term effort reductions in some sectors, stable or slightly reduced catches in core fisheries, and ongoing changes in fleet dynamics.

Discussion

The Plenary requested some additional information on the deep-set buoy gear referenced in the U.S. national report, and sought clarification on whether this gear type is used exclusively for swordfish, if logbook reporting is required, and whether it is classified under the longline dataset. The United States confirmed that this gear targets only swordfish, logbook submission is mandatory, and the fishery is categorized separately from longline. There was a notable increase in striped marlin catches in the U.S. longline fishery in 2024, which stands out due to historically low catch and the current stock status. The United States acknowledged the jump and noted it may be due to some operational changes (e.g., bait type) within the fishery, though further investigation is ongoing.

4 REPORT OF THE CHAIR

ISC Plenary last met face-to-face at ISC24 in Victoria, Canada. While no stock assessments were conducted in 2024, working groups achieved significant progress across species-specific and cross-cutting scientific and management priorities. The Pacific Bluefin Tuna Working Group (PBFWG) concentrated on finalizing the Management Strategy Evaluation (MSE) for Pacific bluefin tuna. Following the successful rebuilding of the stock to the second target reference point of 20% SSBF=0, the group developed a suite of operating and estimation models to simulate fishery and stock dynamics under uncertainty. These efforts culminated in preparations for the February 2025 IATTC-WCPFC-NC Joint Working Group, where preliminary MSE results were presented to inform long-term management procedures for Pacific bluefin tuna. The Billfish Working Group (BILLWG) addressed both scientific and management issues related to billfish stocks. The group responded to a 2024 peer review of the Western and Central North Pacific Ocean striped marlin stock assessment, evaluated the implications of the newly adopted WCPFC Conservation and Management Measure (CMM 2024-06), and ran additional rebuilding scenarios to assess the likelihood of meeting stock recovery targets under new catch allocations. The Shark Working Group (SHARKWG) held a hybrid workshop to conduct an indicator analysis for the North Pacific blue shark stock concluding that there was no compelling evidence of stock concern that would justify advancing the next benchmark assessment ahead of its planned schedule in 2027. The Albacore Working Group (ALBWG) played a critical role in translating scientific metrics from the 2023 North Pacific albacore harvest strategy into actionable management guidance. In response to requests from the WCPFC Northern Committee and IATTC, the group conducted analyses linking fleet-specific fishing intensity to catch and effort-based management controls.

As an independent, science-driven organization the ISC remains committed to delivering the best available scientific information on the 7 key stocks of highly migratory species of interest. ISC scientists are faced with the reality that data streams used to assess stock are generated within dynamic socio-ecological systems and the challenges this brings to developing assessments. As fisheries continue to evolve, ISC science continues to adapt and develop new approaches to ensure these information streams are the best scientific information available. Over the coming years ISC scientists will continue to advance assessment approaches such as the use of assessment model ensembles, explore best practices addressing the realities of shifting fleet distributions and the need to combine fishery dependent information, and the role innovative methods such as CKMR play in stock assessment. As the spatial footprint of individual nation's fisheries change, the most efficient and informative data streams need to be considered. I encourage the ISC to explore the feasibility of combining information across fisheries in the coming years.

ISC Working Groups demonstrated considerable technical advancement in stock assessment methods, indicator development, and the integration of science into management frameworks. These accomplishments support informed decision-making by the RFMOs and contribute to the long-term conservation and sustainable use of North Pacific Ocean tuna and tuna-like species. The credibility of ISC science will depend on ongoing independent review of ISC functions and processes as well as assessments as well as the adherence to Open Science practices. Ongoing financial support for these activities needs to be given serious consideration. With formalization of the ISC making little progress a more structured process needs to be discussed and established to ensure these critical aspects are supported. As indicated by the outgoing Chair at ISC 24, peer reviews of ISC functions are expected to occur every 5 years and the last one occurred in 2018-19. How this review will be supported and what will be reviewed needs to be discussed. Further, 3 of the 7 stocks assessed by the ISC are designated as Northern Stocks, the remainder are not. Consideration needs to be given to how feedback is addressed by the ISC when assessments are presented to the WCPFC-SC for non-Northern Stocks.

The ISC was tasked with considering how to incorporate climate change advice into its management recommendations by NC19. Members have presented on the state of climate research related to fisheries and workgroups took initial steps to complete the matrix of climate effects agreed upon at ISC24. Feedback from the working groups was mixed on the utility of the matrix and there was general consensus that there remain many unknowns with respect to the stock assessed. The ISC will continue to build upon these efforts to better understand how a changing ocean may influence stock productivity and distribution and as uncertainties are resolved over time our ability to provide meaningful management advice will improve. However, this is not a short-term endeavor or insignificant time commitment and research and analyses outside the normal functioning of the working groups is a challenge if it does not align with the research priorities of participants home institutions.

The ISC functions through the in-kind resource and time commitments of its members. I am relatively new to the ISC and in my first year as ISC chair I have appreciated how well the ISC functions because of the leadership within the working groups. Shuya Nakatsuka, Sarah Hawkshaw, Yuichi Tsuda, Michelle Sculley, Yi-Jay Chang, Shui Kai Chang, Michael Kinney, Yasuko Semba, Jenny Suter, and Kirara Nishikawa provided this leadership as Chairs and Vice-chairs and it is their efforts that ensure ISC science continues to produce the best scientific information available. I am very thankful for ISC Vice-Chair Shuya Nakatsuka who generously provides advice and direction when asked. Kirara Nishikawa, Data Administrator and Webmaster for the ISC has also been of great help. Stephanie Flores provided an exceptional service helping me coordinate the documentation for ISC 25. I am also grateful to the National Institute of Fisheries Science for coordinating, on behalf of the Republic of Korea, the logistics of hosting ISC 25 in Busan. Thank you to all the individuals who contributed to the working groups this year, your service to ISC science is invaluable.

5 REPORT OF SPECIES WORKING GROUPS AND REVIEW OF ASSIGNMENTS

5.1 Albacore

S. Hawkshaw presented the activities and report of the Albacore Working Group (ALBWG; **ISC/25/ANNEX/04**). The Plenary was reminded that the next benchmark stock assessment will be presented for plenary review at ISC26. The intersessional tasks of the ALBWG included conducting research to improve the NPO ALB stock assessment and addressing the request from NC to conduct further analyses and provided updated advice on how fishing intensity can be interpreted in actual management controls under the adopted harvest strategy (WCPFC Harvest Strategy 2023-01).

The ALBWG held an intersessional hybrid workshop in March 2025 at the Institute of Oceanography, National Taiwan University, Taipei, Taiwan. Participants from Canada, Chinese Taipei, Japan, USA, and the Inter-American Tropical Tuna Commission (IATTC) attended the workshop, both in-person and virtually. The objectives of this workshop were to: 1) make progress on improvements to biological modelling, data collection and reporting, and abundance indices improvements; 2) address requests for advice from the RFMOs; and 3) create a workplan for the upcoming 2026 stock assessment. During the workshop, the ALBWG reviewed twelve working papers and four presentations and made recommendations for continued progress to further consider inclusion of analyses in the upcoming stock assessment.

2023 Stock Assessment Erratum

The ALBWG also discussed the recent discovery of several errors in Table ES1 (and Table 5.5) of the 2023 NPO ALB stock assessment report (**ISC/23/ANNEX/08**). Errors were found for all the $F_{\%SPR,\,2018\text{-}2020}/F_{\%SPR,\,MSY}$ ratios, as well as the $F_{\%SPR,\,2011\text{-}2020}$ and $F_{\%SPR,\,2011\text{-}2020}/F_{45\%SPR}$ ratios for the base case model. The corrected values did not result in any qualitative change in the reported stock status of NPO ALB and in order to minimize this source of error in future assessments, R code was developed to produce the management quantities directly from model files. A corrected version of the Table ES1 was presented to the plenary for review and explained with more detail in **ISC/25/ANNEX/04**.

Table 5-1 Bold values indicate corrected values from the 2023 stock assessment. Estimates of maximum sustainable yield (MSY), female spawning stock biomass (SSB), fishing intensity (F), and reference point ratios for north Pacific albacore tuna for: 1) the base case model; 2) two important sensitivity models due to uncertainty in growth parameters; and 3) a model representing an update of the 2020 base case model to 2023 data. SSB0, SSBcurrent, F=0 and SSBMSY are the expected female SSB of a population in the equilibrium, unfished state; in the current, dynamic, unfished state; and at MSY, respectively. The Fs in this table are indicators of fishing intensity based on spawning potential ratio (SPR) and calculated as %SPR. SPR is the ratio of the equilibrium SSB per recruit that would result from the estimated F-at-age relative to that of an unfished population. Depletion is calculated as the proportion of the age-1+ biomass during the specified period relative to an unfished age-1+ equilibrium biomass. The model representing an update of the 2020 base case model is similar to but not identical to the 2020 base case model due to changes in data preparation and model structure. *Model may not have converged and uncertainty estimates were unreliable because of the lack of a positive, definite Hessian matrix. †A value of >1 for the depletion ratio indicates higher age-1+ biomass in 2021 relative to the 2006 – 2015 period. §Higher %SPR values indicate lower fishing intensity levels. Values of >1 for ratios of F%SPR to F%SPR-based reference points indicate fishing intensity levels lower than the reference points.

Quantity	Base Case	Growth CV = 0.06 for Linf	Growth All parameters estimated	Update of 2020 base case model to 2023 data*
MSY (t)	121,880	93,167	144,792	97,777
SSB_{MSY} (t)	23,154	18,133	30,435	18,756
SSB_0 (t)	165,567	128,155	198,913	132,570
SSB_{2021} (t)	70,229	35,418	101,161	36,909
$SSB_{current, F=0}$ (2021 estimate)	129,581	97,368	155,542	93,808
$SSB_{2021}/SSB_{current, F=0}$	0.54	0.36	0.65	0.39
$SSB_{2021}/30\%SSB_{current, F=0}$	1.81	1.21	2.17	1.31
$SSB_{2021}/14\%SSB_{current, F=0}$	3.87	2.60	4.65	2.81
† $Depletion_{2021}/Depletion_{2006-2015}$	1.34	1.33	1.37	1.30
§ F%SPR, 2018-2020 (%SPR)	59.0	41.4	70.4	43.2
§ F%SPR, 2011-2020 (%SPR)	**53.3**	36.6	63.8	37.9
¶ F%SPR, 2018-2020/F%SPR, MSY	**3.60**	**2.50**	**3.99**	**2.61**
¶ F%SPR, 2011-2020/F45%SPR	**1.19**	0.81	1.42	0.84
¶ F%SPR, 2018-2020/F45%SPR	1.31	0.92	1.56	0.96
¶ F%SPR, 2018-2020/F%SPR, 2002-2004	1.48	1.63	1.40	1.25

Requests for Science Advice:

The WCPFC (WCPFC; WCPFC-NC18-WP-03) and the IATTC (IATTC; IATTC-100) tasked the ISC with developing criteria for the identification of exceptional circumstances that would result in suspending or modifying the application of the adopted harvest strategy for NPO ALB, and potentially may require updated Management Strategy Evaluation simulation work. The ISC24 Plenary reviewed and supported the criteria for exceptional circumstances for NPO ALB developed by the ALBWG (**ISC/24/ANNEX/08/Attachment 5**). The ALBWG plans to include exceptional circumstances analyses in the upcoming stock assessment process and will continue to review these criteria periodically.

The WCPFC and IATTC also requested scientific advice from the ISC on how fishing intensity should be interpreted to actual management measures under the harvest strategy for NPO ALB (WCPFC Harvest Strategy 2023-01; IATTC Resolution C-23-02). In 2024 the ALBWG produced an advice document **ISC/24/ANNEX/08/Attachment 6** and recommendations were reviewed and supported at ISC24. This advice was then presented at the Western and Central Pacific Fisheries Commission's Northern Committee (WCPFC NC) in 2024. A request was made by the WCPFC NC for the ISC to conduct further analyses of the relationships between fleet-specific spawning potential ratios (SPRs) and effort for the portions of the Japanese longline (JPLL) fishery that targets NPO ALB. In response to this request, the ALBWG first conducted an analysis in 2025 to identify the areas and quarters in which the JPLL fishery likely targeted NPO ALB. The results indicated that the JPLL fishery operating in Areas 1 and 3 during Quarters 1 and 2 (JPLL_A13_Q12) were likely to be targeting NPO ALB because these fleets had consistently high ratios of NPO ALB to total catch, consistently high NPO ALB CPUEs, relatively high NPO ALB catch, and relatively high fishing effort. Similarly, the JPLL fishery operating in Area 2 during Quarters 1 and 4 (JPLL_A2_Q14) were likely to be targeting NPO ALB because these fleets had consistently high ratios of NPO ALB to total catch, and consistently high NPO ALB CPUEs.

Next, the fishing intensity in terms of SPR ($F_{\%SPR}$) were calculated for these two fleets using the methods described in Lee & Taylor (2023). A cross-correlation analysis was then conducted using Pearson's correlation coefficient on the measures of catch, effort, and $F_{\%SPR}$ for the NPO ALB-targeting parts of the JPLL fishery. Then the effort and catch variables were used as explanatory variables in a series of generalized linear models (GLMs) to explain the changes in SPR. The GLMs assumed that the intercept was at 0 (i.e., no intercept was estimated) because a catch or effort of 0 is expected to result in no change in SPR. The results showed that catch and effort metrics (number of days, vessels and hooks) were negatively correlated and showed a relationship with the fleet-specific SPRs. This suggests that these two NPO ALB-targeting JPLL fleets may be able to be managed using effort or catch controls. The increased variability in the relationships between effort and SPRs, relative to catch, should be taken into account. Additional details on this analysis can be found in **ISC/25/ALBWG 01/09.**

The ALBWG also discussed the need for RFMOs to develop rules to allocate the total fishing intensity resulting from the harvest strategy harvest control rule to each of the flags or fleets before fleet specific fishing intensities can be translated into catch and effort.

The ALBWG used the results of the additional analysis and the discussions on allocation to update the recommendations within the science advice document on how fishing intensity can be interpreted in actual management controls under the adopted harvest strategy (**ISC/24/ANNEX/10**).

The list below is a summary of the updated recommendations made by the ALBWG on how fishing intensity should be interpreted to actual management measures under the harvest strategy for NPO ALB:

1. It should be noted that both RFMOs currently maintain fishing effort for NPO ALB at or below the average of 2002 – 2004 levels (e.g., IATTC Resolution C-05-02) and that they have maintained the fishing impact on NPO ALB around or below the target reference point of 45% F%SPR.
2. **The ALBWG cautions** that the fleet-specific catch and effort reduction per unit of SPR presented in the advice document [see Figs. 1, 2 in ISC/25/ANNEX/10] were calculated based on the historical (1994 – 2021) conditions in the 2023 assessment and will likely change if stock conditions (i.e., recruitment and/or selectivity or availability patterns) change in the future. **The ALBWG therefore recommends that the relationships will need to be reevaluated with updated stock assessments and if reference points are exceeded for the stock (i.e., if the SSB falls below the threshold or limit reference points for NPO ALB (30%$SSB_{current,F=0}$ and 14%$SSB_{current,F=0}$) or if exceptional circumstances are identified**.
3. All fleet groups exhibited strong relationships between catch and SPRs and **the ALBWG therefore recommends that changes in fishing intensity required by the NPO ALB harvest strategy can potentially be translated into catch reductions for all fleet groups.**
4. The relationships between effort and SPRs were found to be fleet-specific and tended to be more variable and often less correlated than catch and SPR. However, the fleet groups using surface gears (i.e., JPPL and EPPOSF) exhibited moderately strong relationships between effort and SPRs. In addition, it should be noted that the WCPFC has adopted a management procedure for WCPO SKJ in the WCPO (WCPFC CCM 2022-01) and the JPPL fishery, which targets primarily SKJ, is managed using effort controls under that management procedure CMM. **The ALBWG therefore recommends that changes in fishing intensity required by the NPO ALB harvest strategy can potentially be translated into changes in effort for the management of surface fleet groups, JPPL and EPOSF.**
5. Additional analysis identified two JPLL fleets potentially targeting NPALB (JPLL_A13_Q12 and JPLL_A2_Q14), which had highly negative correlations between SPR, and both catch and effort [see Fig. 3 in ISC/25/ANNEX/10]. **The ALBWG recommends that these two NPALB-targeting JPLL fleets may be able to be managed using effort or catch controls. However, the increased variability in the relationships between effort and SPRs, relative to catch, should be taken into account.**
6. **The ALBWG recommends that RFMOs adopt rules to allocate a proportion of the total fishing intensity resulting from the harvest strategy harvest control rule to each of the flags or fleets before fleet specific fishing intensities can be translated into catch and effort.** As an example, an approach may be for the RFMOs to specify a historical or current time period. The ALBWG can then calculate the mean percentage share of the SPR for each fleet or country during that period. Once the allocation guidelines are provided the ALBWG can provide options for estimating the fleet-specific SPRs such that the desired total SPR values were met, while the share of benefits for each fleet or country were maintained at the desired levels. These fleet-specific SPRs could then in turn be converted into catch and/or effort levels, as needed. An alternative example may be for the RFMOs to specify the exact amounts and/or shares of catch

and/or effort for each fleet or country, and potentially recalculate the exact amounts after every stock assessment.

The ALBWG asked the plenary to review the advice and provide guidance on how to present this advice to the RFMOs.

The ALBWG proposed the following schedule for continuing to address workplan tasks and deliver an updated benchmark stock assessment in 2026:

Date	Location	Task/Event
June 2025	La Jolla, USA	IATTC SAC
June 2025	Busan, Korea	ISC Plenary
July 2025	Japan	NC21
October 27-Nov 2, 2025	Yokohama, Japan	ALBWG workshop: Data Preparation
March 23-30, 2026	La Jolla, USA	ALBWG workshop: Benchmark Stock Assessment 2026

References:

Lee, H.-H., and I. Taylor. 2023. Calculating spawning potential ratio in fishery groups from a seasonal stock assessment model. ISC/23/PBFWG-2/13. Working paper submitted to the ISC Pacific Bluefin Tuna Working Group Workshop, 27 November -1 December, 2023. Webinar.

Discussion

The Plenary discussed the treatment and evaluation of exceptional circumstances for NPO ALB and supported the ALBWG's recommendation to consider these criteria periodically, as new information becomes available and within the stock assessment. The plenary also discussed how the RFMOs have received this advice and the ALBWG noted that no additional requests have been made since these criteria were presented to them in 2024. It was noted that the IATTC Scientific Advisory Committee supported the work of the ALBWG by endorsing the criteria for identify exceptional circumstances at their 2025 meeting.

The Plenary advised the ALBWG on how to best communicate the updated science advice on translating fishing intensity into catch and effort. The updated recommendations included consideration of an additional analysis requested at NC20 to evaluate the relationship between fishing intensity and effort for the JPLL fleets targeting NPO ALB, which was not included in the 2024 analysis given that the effort data from this fleet had not previously been separated from the skipjack targeting effort.

The Plenary also discussed how to handle the erratum identified in the 2023 stock assessment. The importance of transparency was highlighted and it was agreed that the erratum should be clearly appended to the 2023 assessment and posted on the ISC website. **ISC25 agreed that in the future any errata should be clearly appended to the original assessment documents on the ISC website. ISC25 also agreed that if there are substantial changes as a result of the erratum, the Working Group should reissue the stock assessment report and advise the NC and SC on the resulting changes.**

5.2 Pacific Bluefin Tuna

S. Nakatsuka, Chair of the PBFWG, reported on the working groups activities for the past year (**ISC/25/ANNEX/05a, b**). The PBFWG held 2 intersessional workshops, one was online and the other was face-to-face, focusing on development of MSE of PBF. The ISC is tasked by the Joint Working Group (JWG) of WCPFC and IATTC to complete the MSE of PBF in 2025 and the WG completed the task, which is reported in detail under the later agenda. In summary, the WG evaluated the performance of multiple candidate management procedures proposed by the JWG and the JWG now can select any candidate management procedure which satisfies its objectives for its implementation based on the MSE results. In order to facilitate the MSE process, the PBFWG also participated in the intersessional JWG in February and will present the final results at the annual JWG meeting in July.

The PBFWG also addressed other tasks requested by the JWG. First are additional projections (Table 5-2) to reflect the newly adopted management measures in 2024. The WG reviewed the projection results (Figure 5-1) of scenarios that mimic the latest management measures precisely as well as that applies conversion factor of small-fish quota to large-fish quota to the maximum level. It was noted that the projection of new measures is only slightly pessimistic compared to scenario 15 presented in 2024 while the projection of maximum application of the conversion factor produced a much more optimistic result. The detailed results are contained in ISC/24/PBFWG-2/08 in November-December 2024 WG meeting.

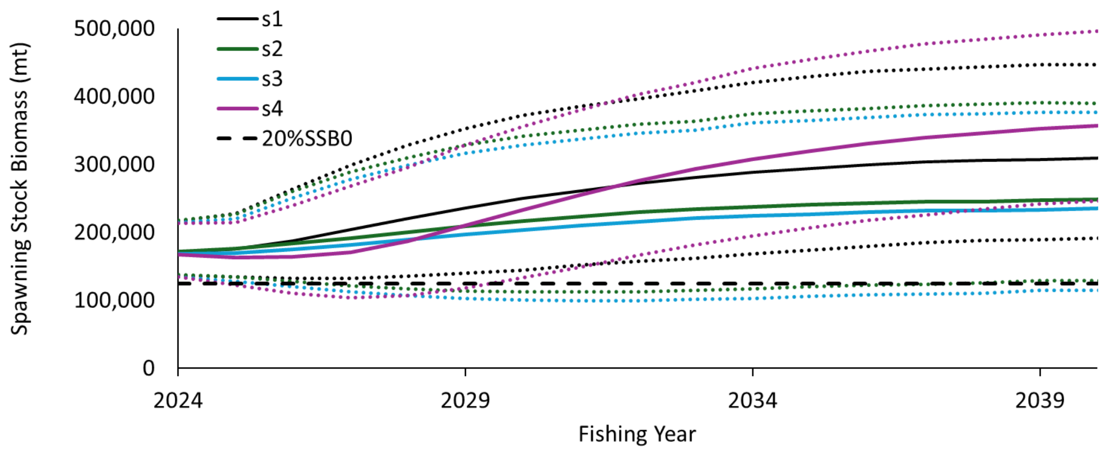

Figure 5-1 Spawning stock biomass trajectory projections for the 4 scenarios presented in Table 5-2. Solid line indicates the median result and the dotted lines represent the 95% interval. The black dashed line indicates 20% of the unfished spawning stock biomass.

The second task is to calculate the conversion factors (Table 5-3) between WPO small to WPO large and WPO large to EPO. It is not simple to calculate conversion factors of quota among fleets where the size of catches are different and variable. In order to calculate the conversion factor, the PBFWG considered the relative expected equilibrium SSB each fleet is removing and compared them. The work was completed intersessionally and confirmed at the short WG meeting on June 16. The resultant conversion factor is reproduced below. It should be noted that the results could vary if conditions, such as selectivity of fleets or natural mortality, are different from those assumed here and the results should be used with caution. For details, see ISC/25/PBFWG-1/02 of 2025 April PBFWG. Those results will be reported to JWG in July as well.

Additionally, the WG reviewed the climate change vulnerability matrix prepared by the ISC Chair and considered that much of the requested information is currently unknown and difficult to fill. In the meantime, the members were encouraged to promote the studies on the impact of climate change on PBF and report it to the WG. The PBFWG also developed a ToR for PBF assessment peer review to be conducted in 2026 and will seek approval of ISC members intersessionally through correspondence. As in the case of MLS assessment review, the reviewers will be nominated by WCPFC CCMs and be selected by ISC. The selected reviewers will be contracted with the WCPFC Secretariat. The peer review meeting is scheduled in March 2026. Finally, the PBFWG conducted an election of chairs and Shuya Nakatsuka was re-elected as Chair for an additional one-year term, after completing two 3-year terms and Shui-Kai (Eric) Chang was elected as Vice-Chair.

Table 5-2 Characteristics of the 4 additional projections requested by the JWG

Harvesting scenarios											
Reference No	Scenarios				Catch limit in the projection						Note
	WCPO		EPO		WCPO					EPO	
					JPN		KOR		TWN		
	Small	Large	Small	Large	Small	Large	Small	Large	Large	Commercial	
1	Status quo (WCPFC CMM2023-02, IATTC Resolution 21-05)				4,007	5,614	718	30	1,965	3,995	JWG 8's request 1(NC19 Summary Report, Attachment E; Maintaining the current CMM)
2	Status quo +10%	Status quo +50%	Status quo +50%		4,407	8,421	790	45	2,948	5,993	Additional request scenario 3 from JWG co-chairs.
3	Status quo +400t	Status quo +4260t	Status quo +2297t		4,407	8,421	718	501	3,187	6,292	New CMM adopted in JWG 9. Update points from s2 are as below. /Korea no increase for small fish, add 501 ton to adult fish /EPO got additional 300t /NZ and AU got 200 and 40t respectivly. For FP calculation, these amount assigned to Taiwanese group.
4	No catch	New CMM for large fish +New CMM for small fish *1.47	New CMM		0	14,899	0	1,556	3,187	6,292	Based on the new CMM adopted by JWG,all small fish catch limits in WPO are transferred with conversion factor to large fish catch limits.

Table 5-3 Table of newly developed conversion factors scaling TAC equivalences of different size PBF. TAC can be converted between size categories from left column to row using the factor in the cell.

Conversion factor	WCPO_S	WCPO_M	WCPO_L	EPO
WCPO_S	1	2.55	6.37	4.22
WCPO_M	0.39	1	2.50	1.66
WCPO_L	0.16	0.40	1	0.66
EPO	0.24	0.60	1.51	1

Discussion

It was noted that there was a request from the WCPC Commission in 2024 for the ISC to undertake research on the migratory patterns of Pacific bluefin, particularly in light of increased catches in the Southern Hemisphere, and a question was raised as to how the PBFWG is planning to address that request. The PBFWG Chair clarified that while the Commission had raised the issue and suggested ISC undertake migratory research, the formal request was expected to be channeled through the NC. **ISC25 endorsed the results of both additional projections and conversion factors and agreed that they be presented at relevant meetings.**

5.3 Billfish

M. Sculley, Chair of the BILLWG provided a summary of BILLWG activities over the past year (**ISC/25/ANNEX/06**). The BILLWG held a hybrid intersessional research meeting in Honolulu, HI in January 2025, which included the ISC Open Science workshop. They also met virtually in May, 2025 and for a half-day prior to Plenary. Delegates from Japan, Chinese Taipei, USA, IATTC, and SPC participated in person or virtually in the meeting. A total of nine working papers and four presentations were reviewed during the meetings. These topics included updates from members on progress with the IBBS program, ongoing and new research on BUM, MLS, and SWO, reviewing the ISC climate matrix, and responding to requests from the ISC Plenary and WCPFC on the potential for a NPO SWO MSE, the WCNPO MLS Peer Review (see **ISC/25/ANNEX/06** - Appendix 4), and additional projections for the WCNPO MLS rebuilding analysis (see **ISC/24/ANNEX/06** - Appendix 5). The WG discussed all the requests and provided responses in the WG report and appendices. The WG also held elections for vice-chair and re-elected Yi-Jay Chang, Chinese Taipei, for another three-year term.

The WG noted that their response to the WCPFC NC request on an NPO SWO MSE was that the members of the WG do not have the capacity to produce one, and recommended a contractor be hired to perform the work under the guidance of the WG. The WG estimates that an MSE could be available to provide advice on harvest strategies within 5 years – 2 years for initial stakeholder engagement and 3 years for model development. The WG notes that the costs would need to include travel to BILLWG meetings, ISC Plenary meetings, WCPFC NC meetings, and any stakeholder engagement meetings as well as computing and storage costs for the MSE development.

As requested by the WCPFC Commission, The WG also provided updated projection runs for the WCNPO MLS rebuilding analysis to reflect the catch distribution by country from the CMM 2024-06, which was adopted at the WCPFC Commission meeting in December, 2024. Three scenarios are provided with a few updates on model configuration. Primarily, reported catch from 2021-2024 were used in the projections instead of estimated catch based upon 2018-2020 fishing mortality. All three scenarios indicate that addition reductions in catch would be necessary in 2028 to meet the rebuilding target of 20%$SSB_{F=0}$ by 2034, and these projections are generally consistent with those provided in 2024 (Table 5-4 and Figure 5-2).

The WG intends to undertake the assessment of Pacific blue marlin in 2026, and have tentatively scheduled a data preparatory meeting in Yokohama, Japan November 11-17, 2025 and an assessment meeting in April, 2026, location TBD.

Table 5-4 Estimated catch (mt), female spawning stock biomass (mt), probability of reaching the rebuilding target, and instantaneous Fishing mortality (-yr) for each of the three projection scenarios: Scenario 1 with no carryover catch in 2025-2027, Scenario 2 with carryover catch in 2025, and Scenario 3 with carryover catch in 2025 and 2026. Values are median estimates for each year.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Scenario 1 - No carryover catch														
Catch	1540	1474	1685	2157	2400	2400	2400	2300	2300	2300	2300	2200	2200	2200
SSB	2638	3973	5521	5716	5414	5015	4707	4515	4390	4275	4197	4167	4165	4191
Probability of reaching rebuilding target	0.06	0.67	0.94	0.92	0.85	0.77	0.71	0.67	0.64	0.62	0.61	0.6	0.6	0.6
Fishing Mortality	0.33	0.23	0.23	0.25	0.28	0.3	0.32	0.32	0.32	0.33	0.34	0.32	0.32	0.32
Scenario 2 - Carryover catch in 2025														
Catch	1540	1474	1685	2157	3225	2400	2400	2200	2200	2200	2200	2200	2200	2200
SSB	2640	3972	5514	5718	5081	4460	4234	4184	4213	4223	2431	4245	4248	4249
Probability of reaching rebuilding target	0.06	0.67	0.94	0.92	0.79	0.67	0.62	0.61	0.61	0.61	0.61	0.61	0.62	0.61
Fishing Mortality	0.33	0.23	0.23	0.4	0.33	0.35	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Scenario 3 - Carryover catch in 2025 & 2026														
Catch	1540	1474	1685	2157	3225	3225	2400	2150	2150	2150	2150	2150	2150	2150
SSB	2640	3975	5526	5722	5074	4121	3690	3743	3894	4021	4108	4195	4258	4306
Probability of reaching rebuilding target	0.06	0.67	0.94	0.91	0.79	0.6	0.51	0.52	0.55	0.57	0.59	0.61	0.62	0.63
Fishing Mortality	0.33	0.23	0.23	0.25	0.4	0.48	0.39	0.35	0.34	0.33	0.32	0.31	0.31	0.31

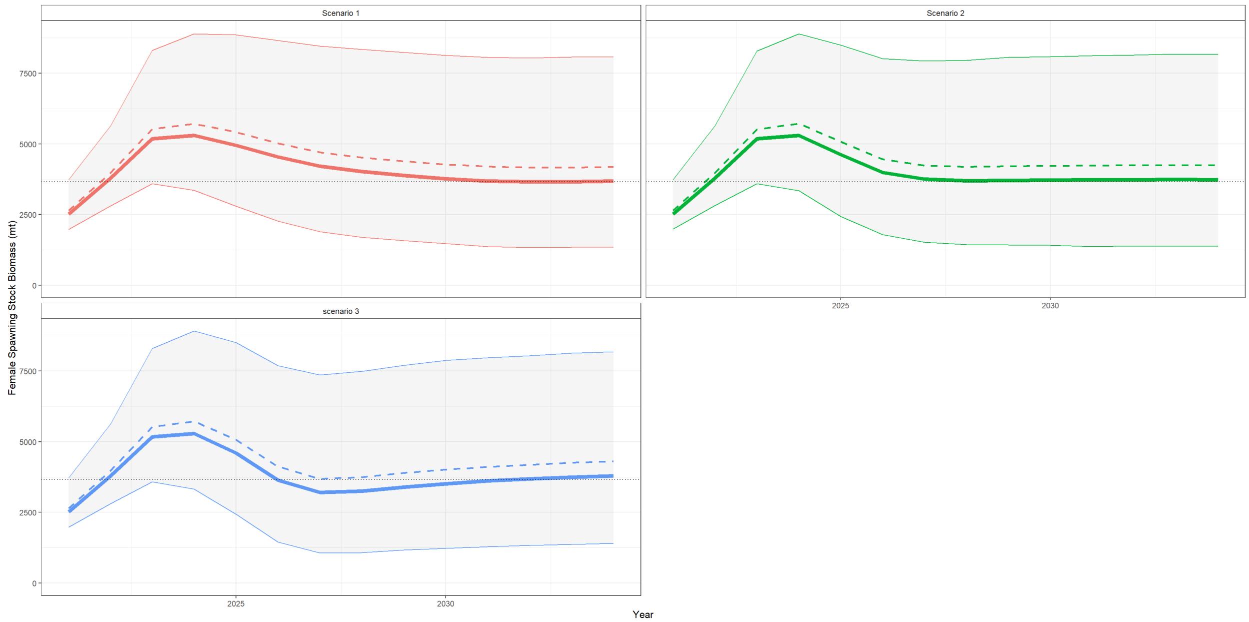

Figure 5-2 Spawning stock biomass trajectory for each of the three scenarios run for the WCNPO striped marlin rebuilding analysis. Solid lines indicate the target biomass (60% probability), dashed lines indicate the median spawning stock biomass, and gray shading indicates 90% confidence intervals.

<u>Discussion</u>

The BILLWG expressed some difficulty in determining how to interpret the requirements of CMM 2024-06 in order to undertake the updated rebuilding analysis. The primary point of confusion related to the treatment of underages and overages in the CMM. The new projections are largely consistent with those from 2024, with only minor changes. It was noted that low catches between 2021 and 2023 (approximately 1,400 mt annually) contributed to a rapid projected recovery of the stock. However, projections also show that catches above 2,400 mt result in a quick decline in stock biomass, highlighting the importance of maintaining a catch limit of 2400 mt.

ISC25 supported the view of the BILLWG regarding the feasibility of swordfish MSE.

5.4 Shark

M. Kinney, SHARKWG Chair, provided a summary of SHARKWG activities over the past year (**ISC/25/ANNEX/07**). The main purpose of this year's Jan/Feb 2025 SHARKWG meeting was to conduct an indicator analysis on NPO blue sharks. To accomplish this the WG reviewed updated CPUE indices for NPO blue shark through 2023. Reviewed indices included Mexico's Ensenada and Mazatlán based longline fisheries, Japanese Kinkai-shallow and research training vessel longline fisheries, US Hawai'i based deep-set and shallow-set longline fisheries, and the Taiwanese longline fishery. The WG calculated a 5-year moving average (right aligned), and a short-term percent change (ST; last moving average year minus 4 to the last moving average year) for each index.

The WG noted that the trend over the last 5 years showed either stable or increasing trends for Mexico's Ensenada (ST 38%), Japan's JRTV (ST 26%), and Taiwan's (ST 16%) longline fleets; a fluctuating trend for Japan's Kinkai-shallow fleet (ST -13%); and a decreasing trend for Mexico's Mazatlán (ST -49%, likely related to target and fishing area shifts) and US shallow-set longline fleet (ST -26%) (Figure 1). Recent change, 2021-2023, for the US deep-set longline was unable to be calculated due to operational changes in the fishery (gear & bait changes). Based on the review of these indices, the WG determined that there was no indication that the next scheduled benchmark assessment for NPO blue shark needed to be advanced from 2027 to 2026.

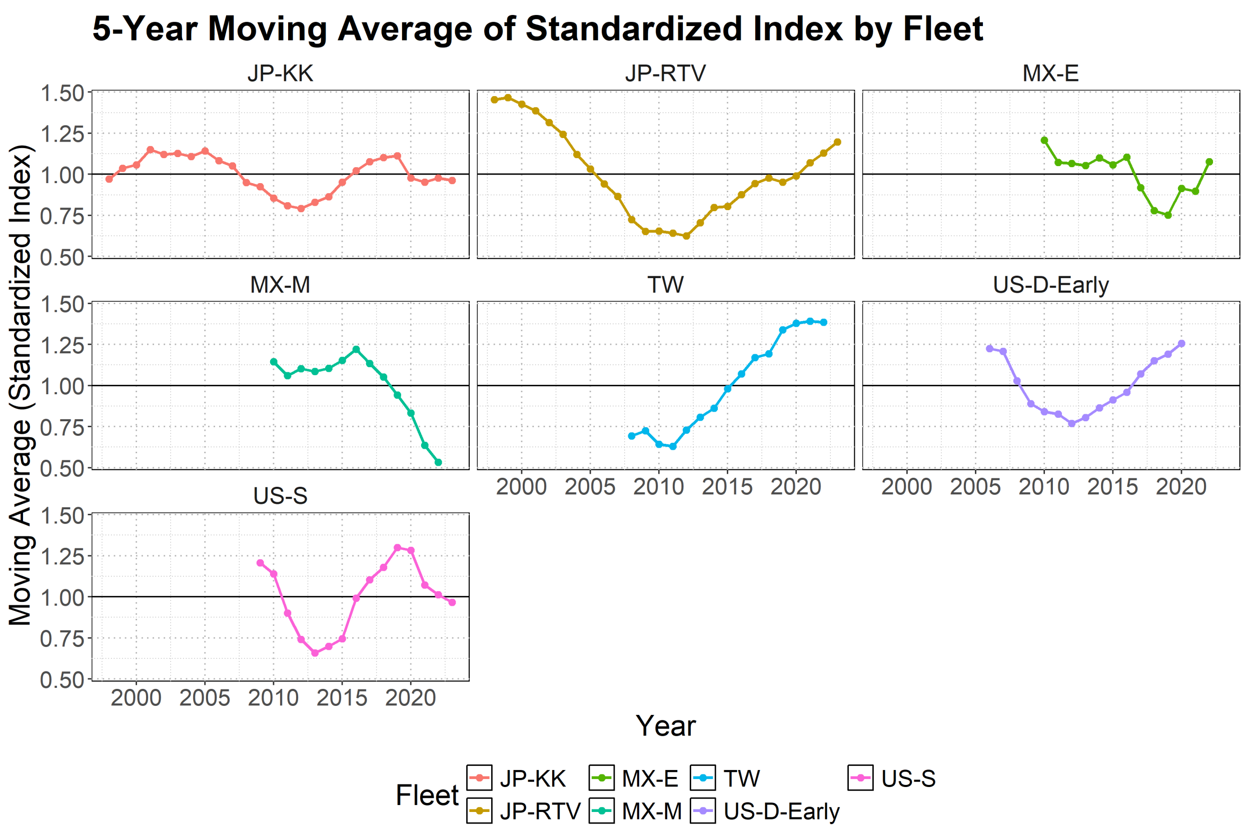

Figure 5-3 Five year moving average of standardized blue shark CPUE indices from seven fleets. Indices were standardized in the same manner as reported in the last blue shark benchmark assessment (ISC 2022 - Stock assessment and future projections of blue shark in the North Pacific Ocean through 2020. Report of the Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, Kona, Hawai'i, U.S.A).

The WG also discussed the utility of conducting future indicator analysis. The WG developed and presented a consensus statement with 4 points outlining the groups reasoning for no longer conducting further indicator analysis. The WG also reviewed and filled in the provided ISC climate change vulnerability matrix, with the group noting some issues on how to interpret some of the climate impacts listed in the matrix in regards to a highly mobile species which can easily migrate away from undesirable environmental conditions. Finally, the WG developed a schedule of future meetings. Unfortunately, a future meeting planned for early June 2025 on developing a CKMR feasibility study for mako sharks, had to be canceled due to US budget cuts. The WG will need to review its options and plan a new path forward for producing a CKMR feasibility study, unfortunately, this may require a postponement of the current schedule for reporting out on this study in August 2026.

Discussion

The Plenary discussed the blue shark indicator analysis conducted by the SHARKWG. The SHARKWG noted no biological concern, based on CPUE trends, with the only notable drop in one fishery from Mexico and attributed this to changes in fishery operations rather than stock status. Members also discussed whether or not it is a useful exercise for the SHARKWG to continue to produce indicator analyses between stock assessments, particularly in the absence of predefined thresholds or management reference points. The SHARKWG has also agreed to proceed with a two-year process for shark assessment development, which will include the development of a conceptual model in the first year, followed by in advance of the data preparation and modeling. The assessment cycle itself remains on a five-year schedule, which is in line with other shark species managed by the WCPFC. There was general agreement by ISC members that the indicator analyses could be discontinued and that the efforts of the SHARKWG could instead be redirected toward improving the full stock assessments. It was also noted that the SHARKWG would need to develop a new timeline for the CKMR feasibility study, due to funding issues encountered in 2025. **ISC25 agreed that the SHARKWG should discontinue the production of future indicator analyses, due to limited utility, and instead focus efforts on improving stock assessments.**

6 PACIFIC BLUEFIN TUNA MSE RESULTS

Desiree Tommasi presented the result of the Pacific bluefin tuna (PBF) Management Strategy Evaluation (MSE). The executive summary of the report is provided below and the main body of the report is available at (insert link once available). The PBF MSE is also available as a Shiny app at https://connect.fisheries.noaa.gov/ISCPBF-MSE-tool.

Pacific bluefin tuna (PBF) is a highly migratory species whose range covers the entire North Pacific and which sustains economically important fisheries in Chinese Taipei, Japan, Korea, Mexico and the United States. Due to its broad range, the stock is managed internationally by two Regional Fisheries Management Organizations (RFMOs), the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter American Tropical Tuna Commission (IATTC). The WCPFC-NC and IATTC PBF Joint Working Group (JWG) was started to coordinate PBF management between these two RFMOs. Fishing records date back to the 1800s, and the stock has experienced high fishing pressure, with spawning stock biomass (SSB) falling to 2% of the unfished SSB (2%$SSB_{F=0}$) in 2009 and 2010. Following the decline of the stock, management measures were put in place by the RFMOs to rebuild the stock to a first rebuilding target of 6.3%$SSB_{F=0}$, and then a second rebuilding target of 20%$SSB_{F=0}$. These management measures were successful, with SSB surpassing the second rebuilding target in 2021.

Now that the stock has rebuilt to the second rebuilding target of 20%$SSB_{F=0}$, the RFMOs have tasked the ISC PBF working group (WG) with developing a management strategy evaluation (MSE) to inform the development of a long-term management procedure (MP) for PBF. MSE is a process that evaluates the tradeoffs and performance of candidate MPs under a range of uncertainties using computer simulations. Testing MPs in an MSE allows for the ruling out of those MPs that do not perform adequately in computer simulations as we would not expect them to perform well in the real world. It also enables managers to identify specific management objectives and quantitative metrics with which to evaluate performance and lays bare the tradeoffs between them.

The RFMOs finalized the candidate harvest control rules (HCRs) to be tested and agreed on the management objectives and performance metrics with which to evaluate their performance in 2023 and requested the ISC PBF WG to finalize the MSE in 2025. In February 2025, after being presented with a set of preliminary results by the ISC, the RFMOs further reduced the HCRs to be tested in the MSE to a final set. This PBF MSE examined the performance of 16 candidate management procedures, relative to the set of management objectives and performance metrics agreed-upon by the RFMOs given uncertainties, using a closed loop computer simulation. The closed loop simulation recreates the real-world management process, from data collection, assessment of stock status, and management procedure implementation (Fig. ES1).

An MP establishes management actions (here, the setting of a total allowable catch, TAC) with the aim of achieving the stated management objectives. It specifies (1) what harvest control rule (HCR) will be applied, (2) how stock status estimates will be calculated (here, via a stock assessment), and (3) how data will be monitored. The MPs in this MSE only differ in terms of the HCRs and associated control points used. As in the real world, estimates of the condition of the PBF stock relative to control points are calculated via a simulated stock assessment, referred to as the estimation model (EM). For this MSE, the EM is an age-structured production model with estimated recruitment deviates (ASPM-R+). The + indicates that size frequency data from the Taiwanese and Japanese longline fleets were included and their selectivities were estimated. It is a simplified version of the 2024 PBF stock assessment model. The virtual stock is monitored by collecting data on catch and size composition as would occur in the real world. Data on catch, size composition, and the index of abundance are generated, with observation errors, from operating models (OMs), which are mathematical representations of the possible true dynamics of the stock and fisheries (Fig. ES1). These observations are then fed into the simulated stock assessment (i.e., the EM). As in the real world, the results from the simulated assessment are then used to inform the management of the PBF fisheries, based on the candidate HCR being tested (Fig. ES1). The resulting management action (i.e., TAC) then impacts the simulated fleets and the PBF stock (Fig. ES1). At the end of the 23-year long simulation, output from the OMs is used to compute performance metrics to assess the performance relative to the set of management objectives of each of the candidate HCRs.

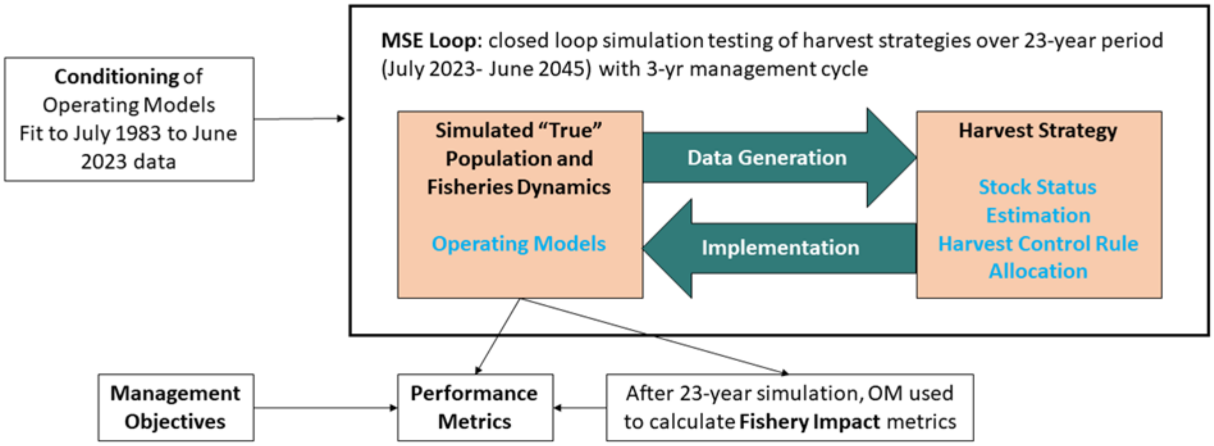

Figure 6-1 Overview of the PBF MSE closed-loop simulation framework showing the MSE feedback loop where data are sampled with error from the operating models and fed into the management procedure, which includes a simulated assessment, which determines stock status and informs the harvest control rule (HCR). The HCR then determines a management action (i.e., TAC) which then affects the dynamics of the "true" population in the operating models.

Management Objectives and Performance Indicators

The management objectives and associated performance indicators for this MSE were agreed upon by the RFMOs following two PBF MSE workshops and additional discussions at two JWG meetings. These are outlined in Table ES1. Performance indicators were used to quantitatively evaluate the performance of the HCRs tested relative to the management objectives.

Harvest Control Rules

The HCRs and reference points considered in this MSE (Table ES2) were put forward by the JWG. The HCRs specify a management action based on SSB estimates in relation to biomass-based control points. More specifically, the HCRs identify, given stock status, a desired fishing mortality (F) on the stock, calculated as 1-SPR, where SPR is the spawning potential ratio, the ratio of the cumulative spawning biomass that an average recruit is expected to produce over its lifetime when the stock is fished at the current fishing level to the cumulative spawning biomass that could be produced by an average recruit over its lifetime if the stock was unfished (Fig. ES2).

Within the MSE simulation, a TAC is then set using the desired F and the current biomass from the EM. The TAC is then kept constant for three years until the next assessment. In addition, the first expected TAC to be applied in 2026 is calculated based on the EM but outside the MSE simulation loop. To do so, the EM was updated with catches and an updated index of abundance for fishing year 2023 (i.e., up to June 2024), the latest year for which data are available. The potential TACs are listed in Table ES4.

Table 6-1 List of management objectives and performance indicators put forward by the JWG and used in the PBF management strategy evaluation. SSB refers to spawning stock biomass, LRP to limit reference point, and F to fishing mortality, measured as 1-SPR where SPR is the spawning potential ratio, the ratio of the cumulative spawning biomass that an average recruit is expected to produce over its lifetime when the stock is fished at the current fishing level to the cumulative spawning biomass that could be produced by an average recruit over its lifetime if the stock was unfished. FTARGET is the target reference point based on fishing mortality.

Category	Management Objective	Performance Indicator
Safety	• There should be a less than 20%* probability of the stock falling below the LRP	• Probability that SSB< LRP in any given year of the evaluation period
Status	• To maintain fishing mortality at or below F_{TARGET} with at least 50% probability	• Probability that F≤F_{TARGET} in any given year of the evaluation period • Probability that SSB is below the equivalent biomass depletion levels associated with the candidates for F_{TARGET}
Stability	• To limit changes in overall catch limits between management periods to no more than 25%, unless the ISC has assessed that the stock is below the LRP	• Percent change upwards in catches between management periods excluding periods when SSB<LRP • Percent change downwards in catches between management periods excluding periods when SSB<LRP
Yield	• Maintain an equitable balance in proportional fishery impact between the WCPO and EPO	• Median fishery impact (in %) on SSB in the terminal year of the evaluation period by fishery and by WCPO fisheries and EPO fisheries
	• To maximize yield over the medium (5-10 years) and long (10-30 years) terms, as well as average annual yield from the fishery	• Expected annual yield over 5-10 years of the evaluation period, by fishery • Expected annual yield over 10-30 years of the evaluation period, by fishery • Expected annual yield in any given year of the evaluation period, by fishery
	• To increase average annual catch in all fisheries across WCPO and EPO	

*The acceptable levels of risk may vary depending on the LRP selected, but should be no greater than 20%.

Table 6-2. List of harvest control rules (HCRs) tested in the PBF MSE. The target reference point (FTARGET) is an indicator of fishing mortality based on SPR. SPR is the spawning potential ratio. An FTARGET of FSPR40% is associated with a fishing mortality that would leave 40% of the SSB per recruit compared to the unfished state. An FTARGET of FSPR20% implies a higher fishing mortality (i.e., 1-SPR of 0.8) and would result in a SSB per recruit of 20% of the unfished SPR. The threshold (ThRP) and limit reference points (LRP) are SSB-based and refer to the specified percentage of equilibrium unfished SSB (SSBF=0). The minimum F (Fmin) refers to the fraction of the FTARGET that the fishing intensity is set to when SSB is below the LRP, except for HCRs 4 and 12, which specify a specific fishing mortality. Note that for HCRs 5 and 13, when the ThRP is breached, the HCR switches from constant fishing mortality at the FTARGET to a constant TAC set at the catch limits defined in CMM2021-02

(WCPFC 2021) and C-21-05 (IATTC 2021). While HCRs 5, 6, 7, 13, 14, and 15 do not use LRPs as control points, an LRP of median SSB from 1952-2014 (6.3% SSBF=0) has been specified by the JWG to compute performance metrics. HCRs 9 to 16 are identical to HCRs 1 to 8, except for the allocation of fishing pressure between the Western Central Pacific Ocean (WCPO) fleet segment and the Eastern Pacific Ocean (EPO) fleet segment. HCRs 1 to 8 were tuned to reach a fishery impact ratio between the WCPO and EPO of 80% to 20% (80:20), while HCRs 9 to 16 were tuned to reach a WCPO:EPO fishery impact ratio of 70:30.

HCR number	F_{TARGET}	Control Point 1 (ThRP)	Control Point 2 (LRP)	Number of Control Points	F_{min}	WCPO:EPO Impact Ratio
1	FSPR30%	20%$SSB_{F=0}$	15%$SSB_{F=0}$	2	10% F_{TARGET}	80:20
2	FSPR30%	25%$SSB_{F=0}$	15%$SSB_{F=0}$	2	10% F_{TARGET}	80:20
3	FSPR40%	25%$SSB_{F=0}$	20%$SSB_{F=0}$	2	10% F_{TARGET}	80:20
4	FSPR30%	20%$SSB_{F=0}$	10%$SSB_{F=0}$	2	FSPR70%	80:20
5	FSPR25%	20%$SSB_{F=0}$	NA	1	NA	80:20
6	FSPR20%	20%$SSB_{F=0}$	NA	1	NA	80:20
7	FSPR25%	15%$SSB_{F=0}$	NA	1	NA	80:20
8	FSPR30%	20%$SSB_{F=0}$	7.7%$SSB_{F=0}$	2	5% F_{TARGET}	80:20
9	FSPR30%	20%$SSB_{F=0}$	15%$SSB_{F=0}$	2	10% F_{TARGET}	70:30
10	FSPR30%	25%$SSB_{F=0}$	15%$SSB_{F=0}$	2	10% F_{TARGET}	70:30
11	FSPR40%	25%$SSB_{F=0}$	20%$SSB_{F=0}$	2	10% F_{TARGET}	70:30
12	FSPR30%	20%$SSB_{F=0}$	10%$SSB_{F=0}$	2	FSPR70%	70:30
13	FSPR25%	20%$SSB_{F=0}$	NA	1	NA	70:30
14	FSPR20%	20%$SSB_{F=0}$	NA	1	NA	70:30
15	FSPR25%	15%$SSB_{F=0}$	NA	1	NA	70:30
16	FSPR30%	20%$SSB_{F=0}$	7.7%$SSB_{F=0}$	2	5% F_{TARGET}	70:30

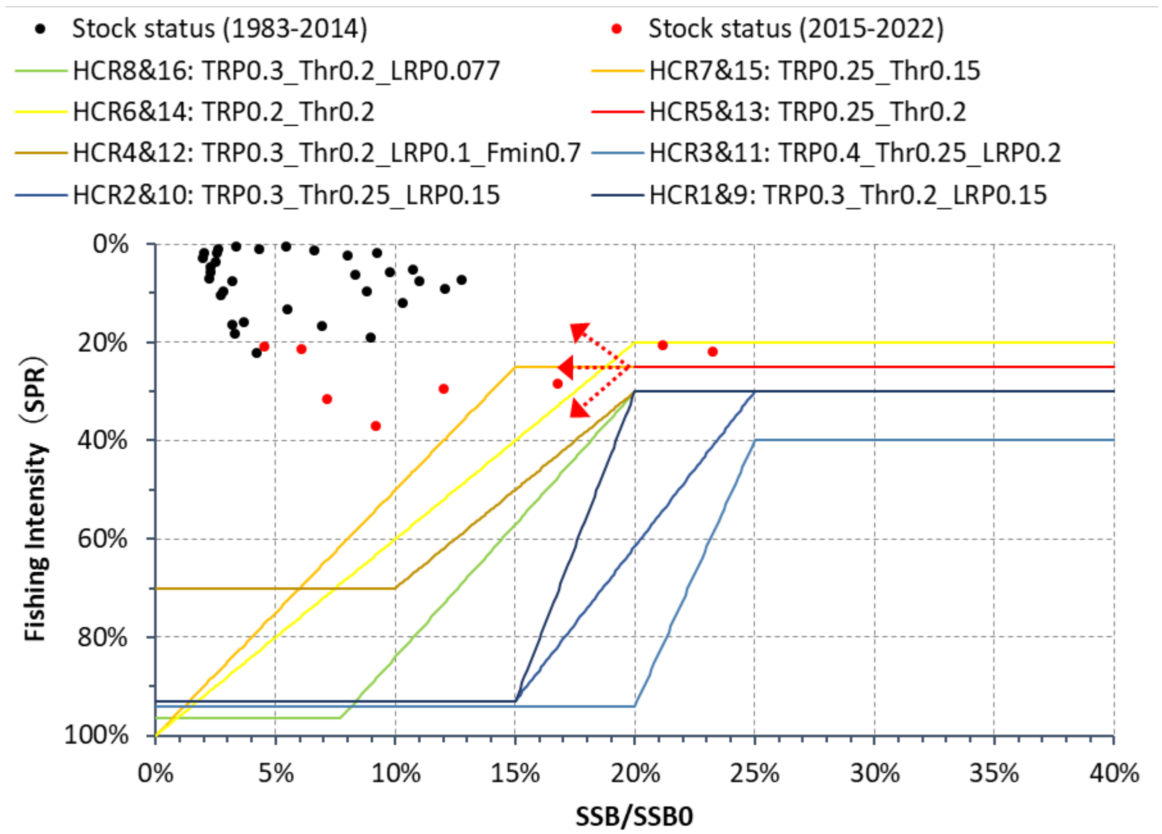

Figure 6-2 Candidate HCR evaluated in the PBF MSE. Fishing intensity is an indicator of fishing mortality based on SPR. SPR is the spawning potential ratio that would result from the current year's pattern and intensity of fishing mortality relative to the unfished stock. SSB/SSBF=0 is SSB relative to the equilibrium unfished SSB (SSBF=0). The points are annual estimates of SPR and relative SSB from the latest PBF stock assessment (ISC 2024). Red dots represent the years when stricter catch limits were in place to rebuild the stock. For HCR 5 (red line), a constant catch management, which was similar to the one applied in 2015-2022, is used if the SSB breaches a control point set at 20%SSBF=0. Resulting illustrative fishing intensities for a constant catch are shown as dashed arrows. Note that HCRs 9 to 16 are not represented as they are identical in shape to HCRs 1 to 8.

These HCRs define the management action to be taken (i.e., F) given the estimated ratios of SSB to biomass-based control points from the simulated stock assessments. All the HCRs considered in this MSE have a target state based on fishing mortality (F_{TARGET}). This is the target reference point (TRP) and the state that management wants to achieve. Some HCRs have two control points, with the first being labeled the threshold reference point (ThRP) and the second being labeled the limit reference point (LRP). Having two control points generally helps avoid reaching low biomass levels, where severe management action is taken, and rebuild the stock back to a target state faster. Figure ES2 outlines, for each HCR, the allowed F based on the status of estimated SSB relative to $SSB_{F=0}$. For all HCRs, if SSB is above the first control point, F is managed to be at the F_{TARGET} (Fig. ES2). If SSB falls below the first control point, the allowed F is reduced, except for HCR 5 and 13, in proportion to the estimated relative SSB down to a minimum level at the second control point for HCRs with two control points or down to 0 for those with one control point, to allow biomass to increase back to the target (Fig. ES2). For HCRs 5 and 13, a constant catch management, which was similar to the one applied in 2015-2022, is applied if the SSB breaches its first control point. Historically, the stock has been under intense fishing pressure, and F as estimated by the latest stock assessment has never been at a 40%SPR level, even when the stricter management measures were in place (Fig. ES2).

It is important to note that the LRPs and TRPs in the HCRs serve both as control points of management actions and as measuring sticks to evaluate performance. However, control points can differ from the LRPs and TRPs. LRPs and TRPs, in principle, can also simply play the role of reference points to evaluate the performance of HCRs. In these cases, the level of the LRPs and TRPs would only be used as measuring sticks without affecting the management actions under the HCRs.

Uncertainties considered

MSE recreates the real-world management process to ensure that management procedures will work even in the presence of errors in the observations, assessment, and implementation. The PBF MSE framework therefore adds realistic error to the data used in the simulated stock assessments (i.e., the EMs). As in the real world, the MSE framework also runs the EM every three years and estimates stock status with this data to ensure that estimation error is considered. The MSE also simulates a realistic lag between the availability of data used in the assessment and the implementation of management actions. For instance, the first EM in the MSE uses data up to fishing year 2023 (i.e., up to June 2024) to set a TAC that is applied starting in calendar year 2026. TACs are provided in three categories of fleets; WPO large fish, WPO small fish, and EPO, based on the recent (2015-2022) selectivity. Since the fleets may catch more than assigned by the TAC due to discards, the MSE also includes an implementation error by adding 1.2% higher catch than set by the HCR to EPO recreational fleets, 5% higher to the WCPO fleets except for the Japanese troll for penning fleet, which is set at 100% higher to account for potentially high discards.

In addition to uncertainty related to the management process, the MSE also considers uncertainty stemming from our limited understanding of the true population or fisheries dynamics. This was addressed by developing 20 different OMs, each representing an equally plausible "true" version of the system. In developing the potential OMs, the ISC PBF WG reviewed potential sources of uncertainty for the PBF stock and identified natural mortality, growth, and the steepness parameter as the most influential sources of uncertainty. The PBF WG then diagnosed plausible ranges for these parameters and developed population dynamics models using the resulting parameter combinations. Models that passed a series of quantitative diagnostic tests to ensure they were plausible and could reasonably replicate past PBF observations were selected as a reference set and given equal weight. Models that demonstrated unsatisfactory diagnostics were discarded. The OM reference set spans a wide range of stock statuses (Fig. ES3). All results and performance metrics are calculated across this entire reference set.

In addition to the reference set, the PBF WG also developed three robustness tests. These are less likely than the reference set and so should not be given the same weight, but are still considered plausible. They are a way to test HCR behavior under extreme conditions detrimental to stock productivity. These robustness tests were: 1) a doubling of discards; 2) an effort creep for the Taiwanese longline fleet on which the main index of abundance is based; and 3) about a 40% 10-year long drop in recruitment, starting from 2042. These robustness OMs were constructed by modifying OM1, which has the same settings as the 2024 base-case assessment model. Results for the robustness set are presented separately. Finally, as PBF recruitment can vary greatly between years due to unknown environmental factors, even when SSB remains stable, the MSE also considered process uncertainty in recruitment. This was done by, for each OM, sampling recruitment deviations from a normal distribution with a mean of 0 and standard deviation σ_R=0.6 in log space.

For each HCR-OM combination, 100 iterations with different random trajectories in recruitment were run. Less than 1% of all the simulated assessments had estimation issues and had an extremely high estimation error (> 1000% absolute relative error) or produced unrealistically low estimated SSB (less than 1 fish) that were not seen in the OMs and were not caused by the HCRs. These unrealistically low estimated SSBs appeared to be caused by unrealistic estimation error due to non-convergence. While this only happened for EMs in some assessment years, iterations, and OMs, to ensure the HCRs were exposed to the same recruitment trends, we discarded the iterations associated with this estimation issue for all OMs and HCRs, leaving a total of 81 iterations per OM/HCR combination with which to compute performance metrics. Removing these iterations was considered reasonable given that it did not greatly affect the performance metrics (see details in main text).

Table 6-3 List of the 20 operating models (OMs) in the reference set representing different productivity scenarios and their parameter specifications. The models were considered equally plausible and given equal weight in the calculation of performance metrics. M2+ refers to natural mortality for age 2 and older fish, L2 refers to the length at age 3, and h refers to steepness. OM 1 has the same parameter specifications as the current base case stock assessment for Pacific bluefin tuna.

OM #	M_{2+}	L_2	h	OM #	M_{2+}	L_2	h
1	0.25	118.57	0.999	12	0.25	118.57	0.99
2	0.25	118	0.91	13	0.25	119	0.99
3	0.193	118.57	0.97	14	0.25	118	0.97
4	0.193	118	0.999	15	0.25	119	0.97
5	0.193	118	0.99	16	0.25	118	0.95
6	0.193	118.57	0.99	17	0.25	118.57	0.95
7	0.193	119	0.99	18	0.25	119	0.95
9	0.25	118	0.999	19	0.25	118	0.93
10	0.25	119	0.999	20	0.25	118.57	0.93
11	0.25	118	0.99	21	0.25	119	0.93

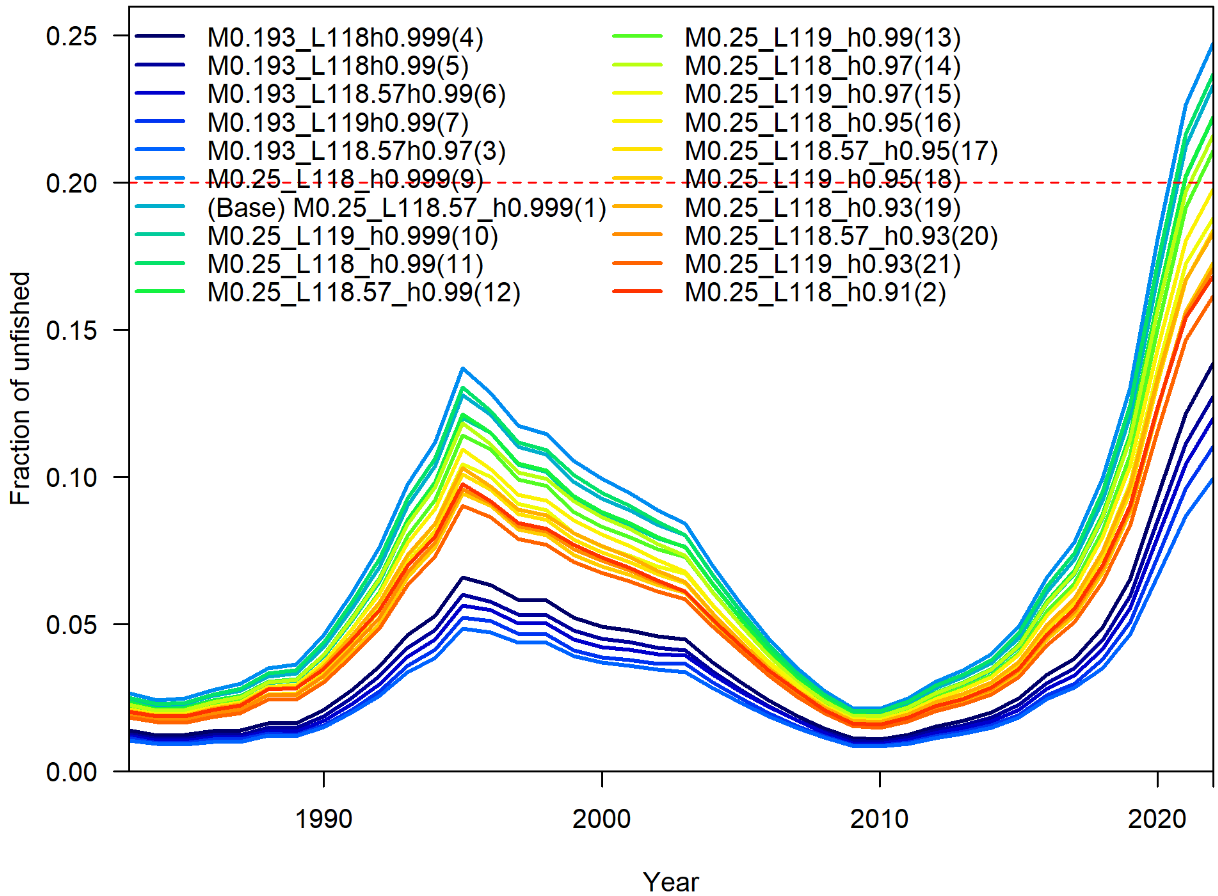

Figure 6-3 Historical trajectory of the relative spawning stock biomass estimated from each of the 20 operating models (OMs) in the reference set representing different productivity scenarios and their parameter specifications. The dashed line indicates the rebuilding target at 20%SSBF=0. The models were considered equally plausible and given equal weight in the calculation of performance metrics. M refers to natural mortality for age 2 and older fish, L refers to the length at age 3, and h refers to steepness. The OM number in parentheses refers to Table ES3. OM 1 has the same parameter specifications as the current base case stock assessment for Pacific bluefin tuna.

Results

The results of the MSE analysis can be summarized in eight main points:

1. *All HCRs were able to maintain a low probability (<20%) of the stock breaching their respective LRP and the IATTC's interim reference point for tropical tunas of 7.7%$SSB_{F=0}$. In addition, all HCRs except for HCRs 6 and 14 were also able to maintain a low probability (<20%) of breaching the second rebuilding target of 20%$SSB_{F=0}$. Under all HCRs, median SSB increased from initial conditions to levels above their respective targets (Fig. ES4).*

Even when considering the range of uncertainties in stock productivity, recruitment variability, observation, estimation, and implementation, all HCRs met the safety objective and had a less than a 20% probability of SSB being below their respective LRP and a less than 10% probability of breaching the IATTC's interim reference point for tropical tunas (Figs. ES5 and ES6, Table ES4). Furthermore, all HCRs except 6 and 14, had a less than 20% probability of SSB being below the second rebuilding target of 20%$SSB_{F=0}$ (Fig. ES7, Table ES4). Also, under all HCRs, median SSB increased from initial conditions to levels above their respective targets (Fig. ES4).

The PBF WG has no specific recommendation for an LRP with which to test safety performance, especially given that the PBF stock has recovered from a very low level of SSB (2% of $SSB_{F=0}$).

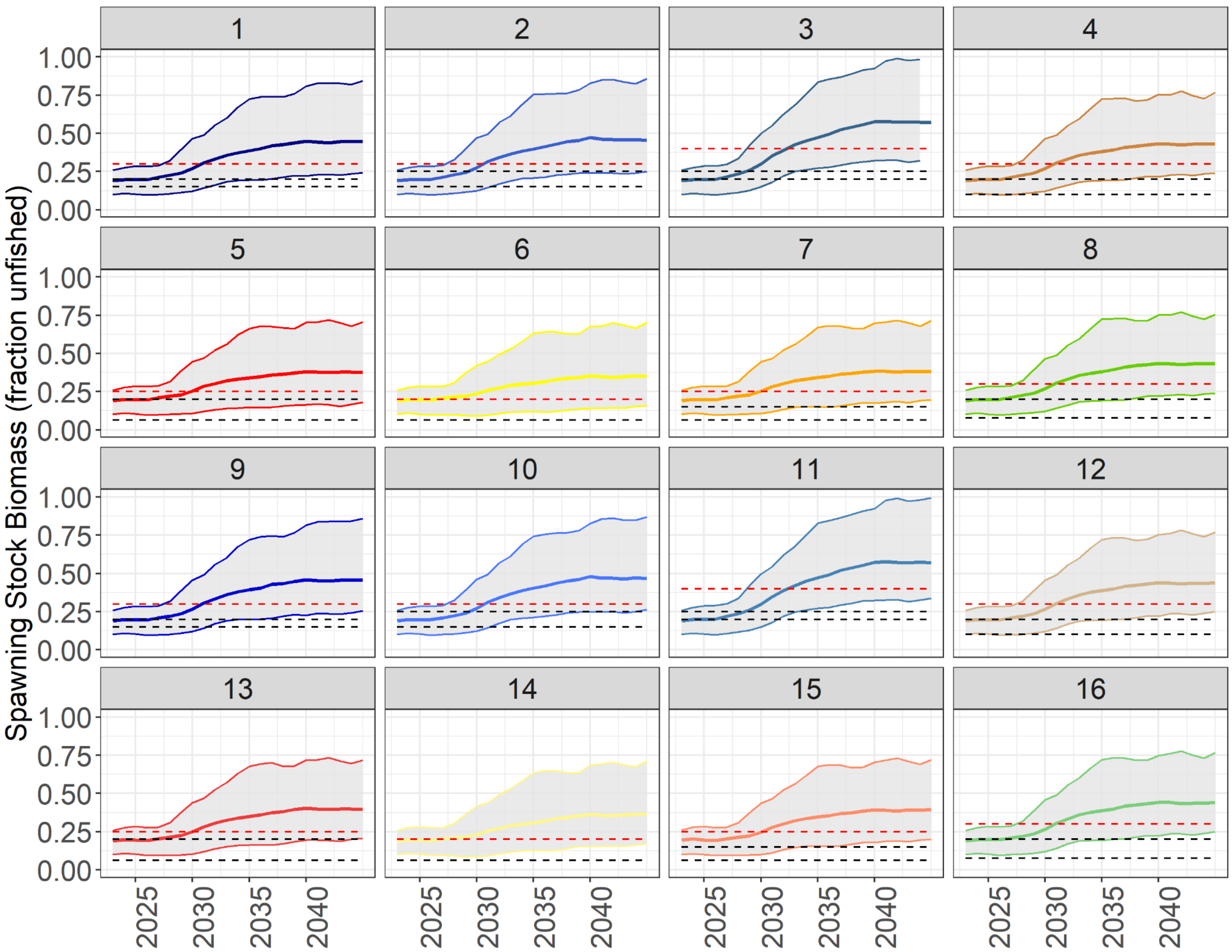

Figure 6-4 Trends in median relative spawning stock biomass (SSB/unfished SSB, thick solid color lines) from the operating models under all iterations and reference scenarios by harvest control rule (HCR). The grey shading represents trends in the 5th to 95th quantile range. The lowest black dotted line represents the lowest control point for each HCR, and the highest black dotted line represents the highest. The dashed red line represents the SSB

associated with the respective FTARGET. Note that HCRs 5, 6, 7, 13, 14, and 15 do not have a second control point, so the lowest dashed line marks the LRP specified by the JWG to assess performance.

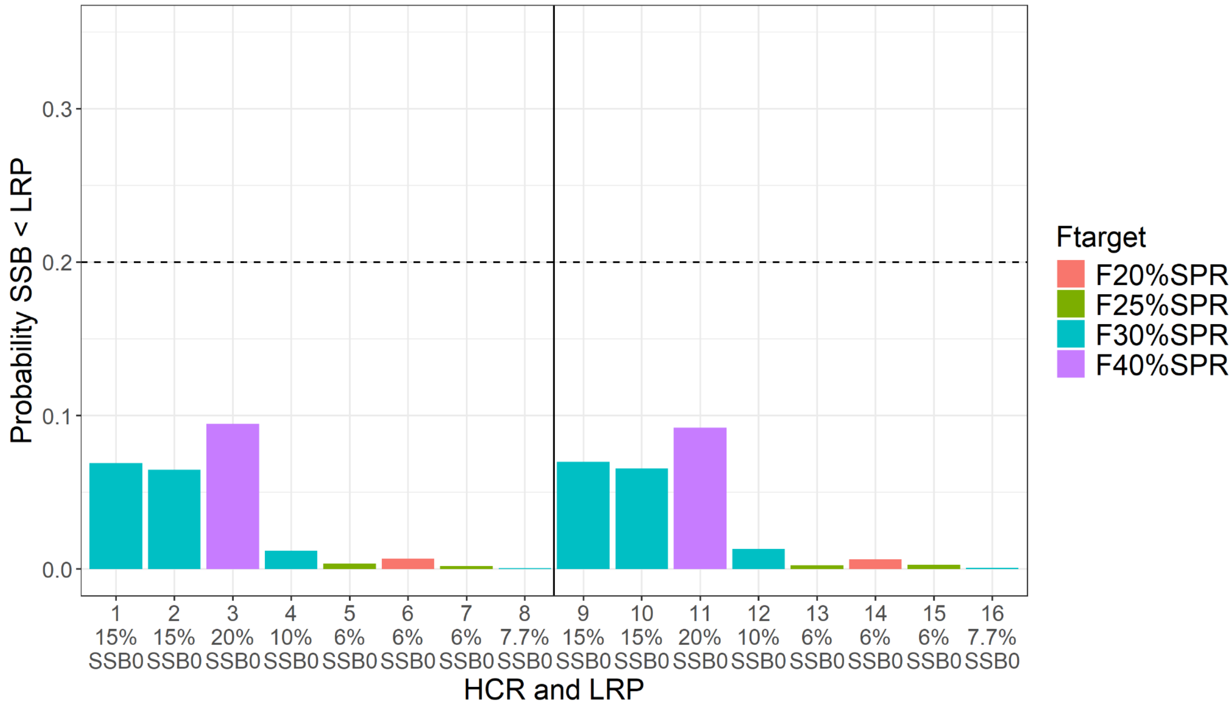

Figure 6-5. Probability, for each harvest control rule (HCR), of spawning stock biomass (SSB) being below the limit reference point (LRP) specified by each HCR across all reference scenarios, iterations, and simulation years. Colors represent the FTARGET reference point associated with each HCR. The x-axis shows both the HCR number and the LRP relative biomass level associated with each HCR. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean and WCPO for Western Central Pacific Ocean.

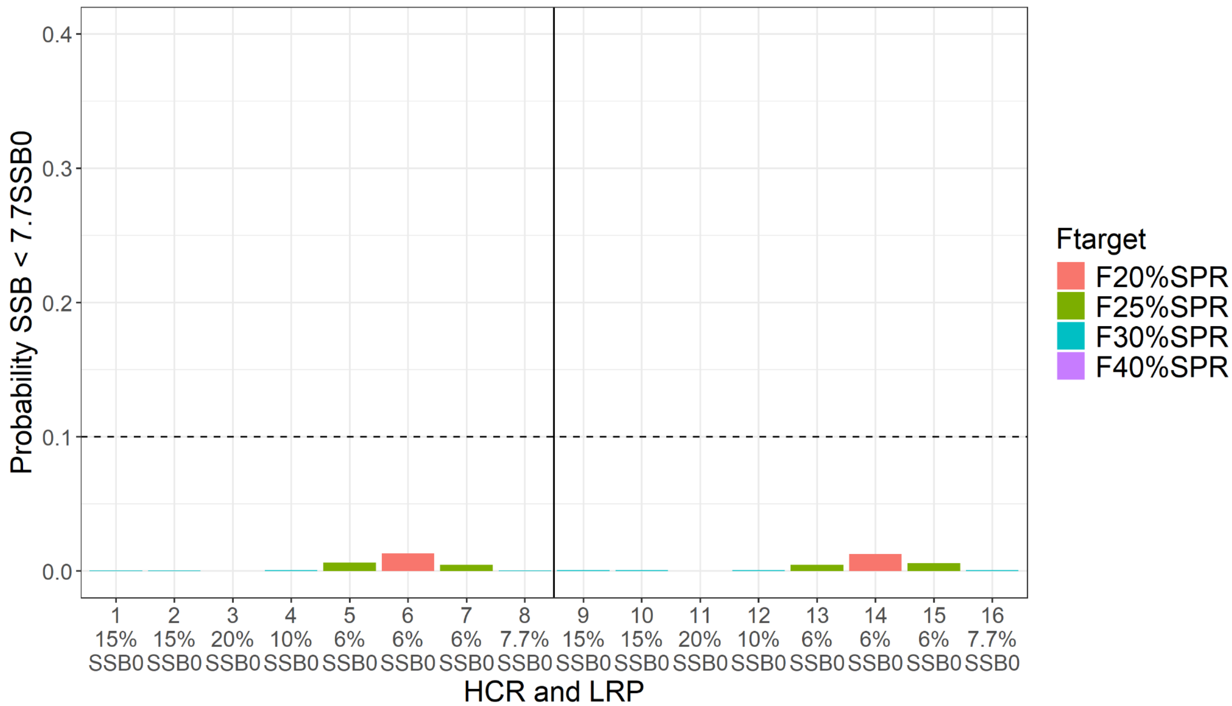

Figure 6-6 Probability, for each harvest control rule (HCR), of spawning stock biomass (SSB) being less than 7.7%SSBF=0 across all reference scenarios, iterations, and simulation years. The x-axis shows both the HCR number and the LRP relative biomass level associated with each HCR. Colors represent the FTARGET reference point associated with each HCR. The horizontal dotted line represents a 10% probability. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean and WCPO for Western Central Pacific Ocean.

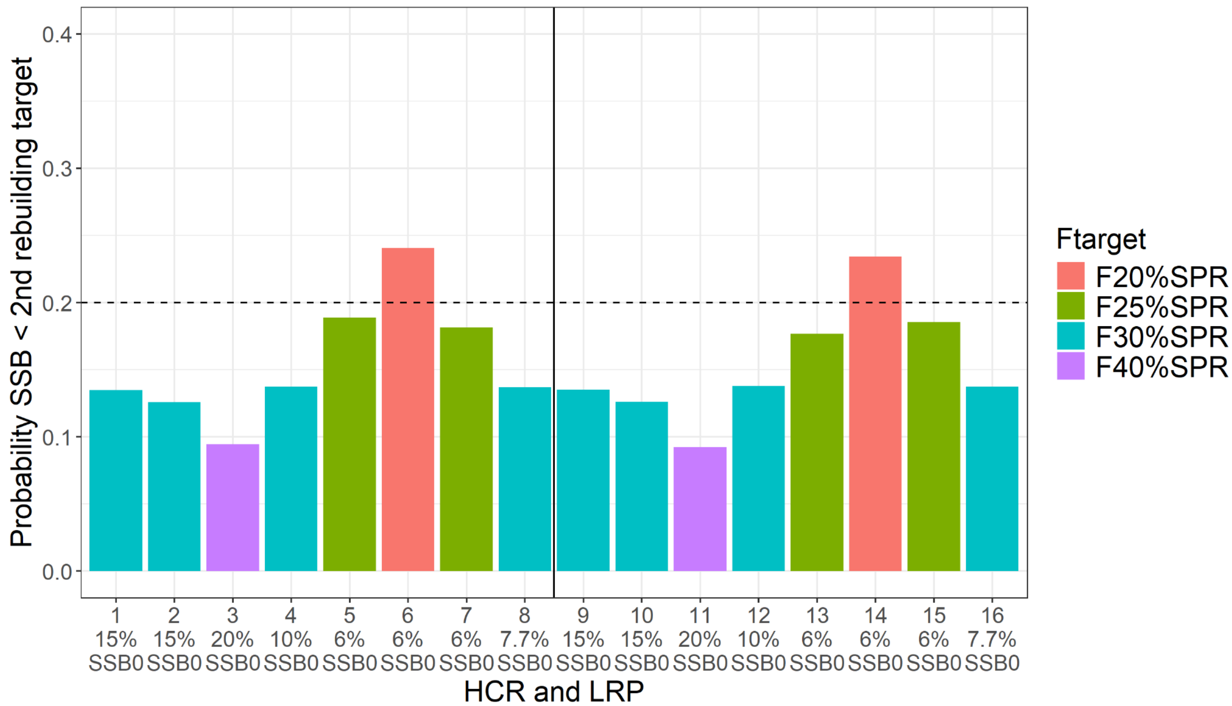

Figure 6-7 Probability, for each harvest control rule (HCR), of spawning stock biomass (SSB) being less than 20%SSBF=0 across all reference scenarios, iterations, and simulation years. The x-axis shows both the HCR number and the LRP relative biomass level associated with each HCR. Colors represent the FTARGET reference point associated with each HCR. The horizontal dotted line represents a 20% probability. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean and WCPO for Western Central Pacific Ocean.

2. *There was a tradeoff between the safety metrics (e.g., probability of being at or above the second rebuilding target of 20%$SSB_{F=0}$) and yield metrics (e.g., median annual catch in mt). Those HCRs that had the highest probability of SSB being at or above the second rebuilding target had the lowest yield metrics and vice-versa.*

Due to their higher F_{TARGET}, HCRs 3 and 11 maintained a higher SSB and had the highest probability of SSB being at or above the second rebuilding target of 20%$SSB_{F=0}$, but this came at the cost of lower yields (Fig. ES8), with these HCRs having the lowest total catch, as well as the lowest fleet segment specific (i.e., WCPO large, WCPO small, and EPO) TACs (Figs. ES9, ES10, ES11, and ES12, Table ES4). HCRs with the same F_{TARGET} perform similarly for safety and yield metrics.

Given tradeoffs between the different performance indicators, the choice of a preferred HCR is dependent on the priorities of the respective managers and stakeholders regarding the different management objectives and their level of risk aversion.

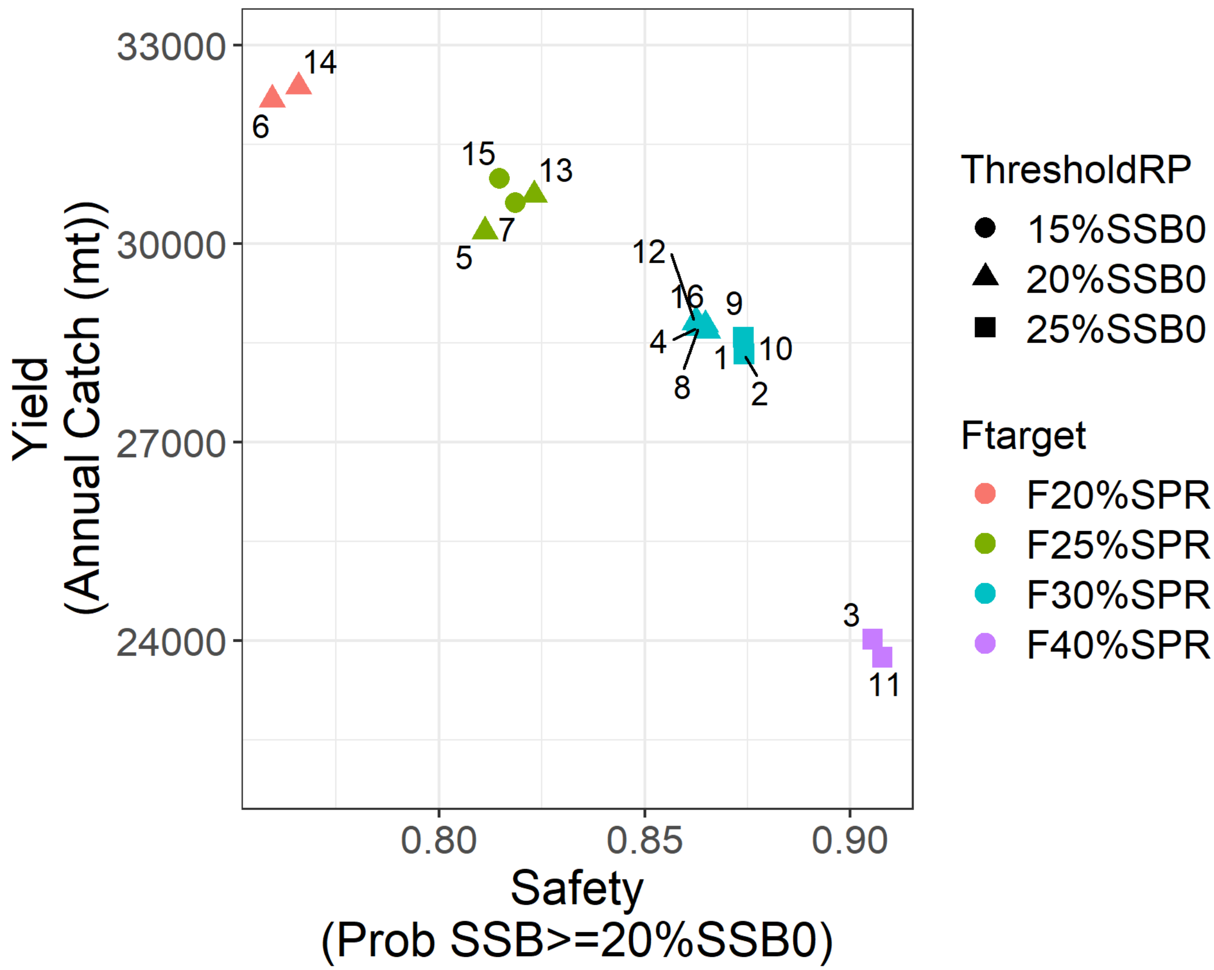

Figure 6-8 Median annual total catch versus the probability of spawning stock biomass (SSB) being at or above the second rebuilding target of 20%SSBF=0. Note that to ensure that for both measures a higher value is better, here we reversed the second performance metric shown in Fig. ES5 to be the probability of SSB≥20%SSBF=0 instead of the probability of SSB<20%SSBF=0. Each HCR is labeled and colored according to their FTARGET. Each symbol represents a different ThresholdRP, which is the first control point for each HCR and stands for Threshold Reference Point.

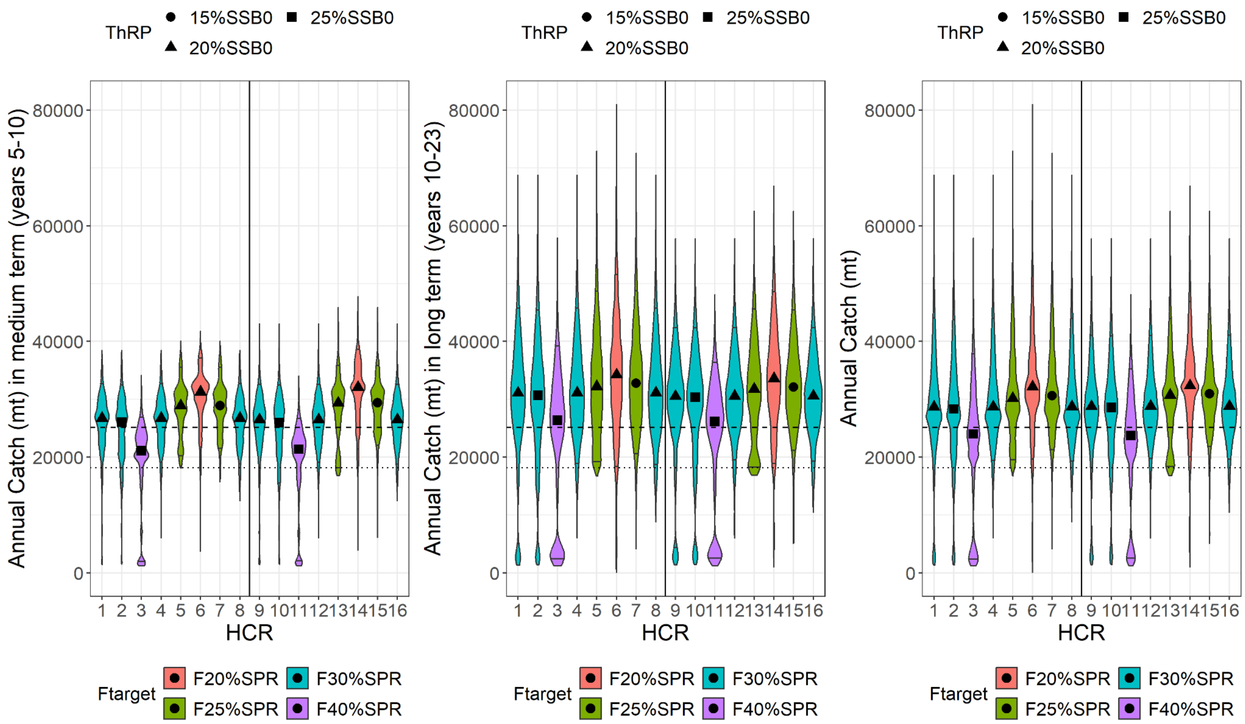

Figure 6-9 Violin plots showing the probability density of total annual catch (including discards and the EPO recreational fleet) for each harvest control rule (HCR) across all iterations, reference scenarios, and simulation years in the medium term (first panel), long term (second panel), and all years (third panel). The medium term shows the annual catch distribution over years 5 to 10 of the simulation, while the long term shows the distribution over years 10 to 23 of the simulation. Colors represent the FTARGET reference point associated with each HCR. The marker inside each violin plot is the median value for the medium term, long term, or annual catch, and horizontal solid lines within each violin represent the 5th to 95th quantile range. The shape of each marker represents the ThresholdRP (ThRP), which is the first control point for each HCR and stands for Threshold Reference Point. The dotted line identifies the total catch limit set by the WCPFC's CMM 2023-02 plus IATTC's Resolution C-21-05, effective in 2024, plus EPO recreational catches for the calendar year 2023. The dashed line identifies the total catch limit set by the WCPFC's CMM 2024-01 plus IATTC's Resolution C-24-02, effective in 2025, plus EPO recreational catches for the calendar year 2023. For the IATTC's resolution, catch limits were based on half of the biennial TAC. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean and WCPO for Western Central Pacific Ocean.

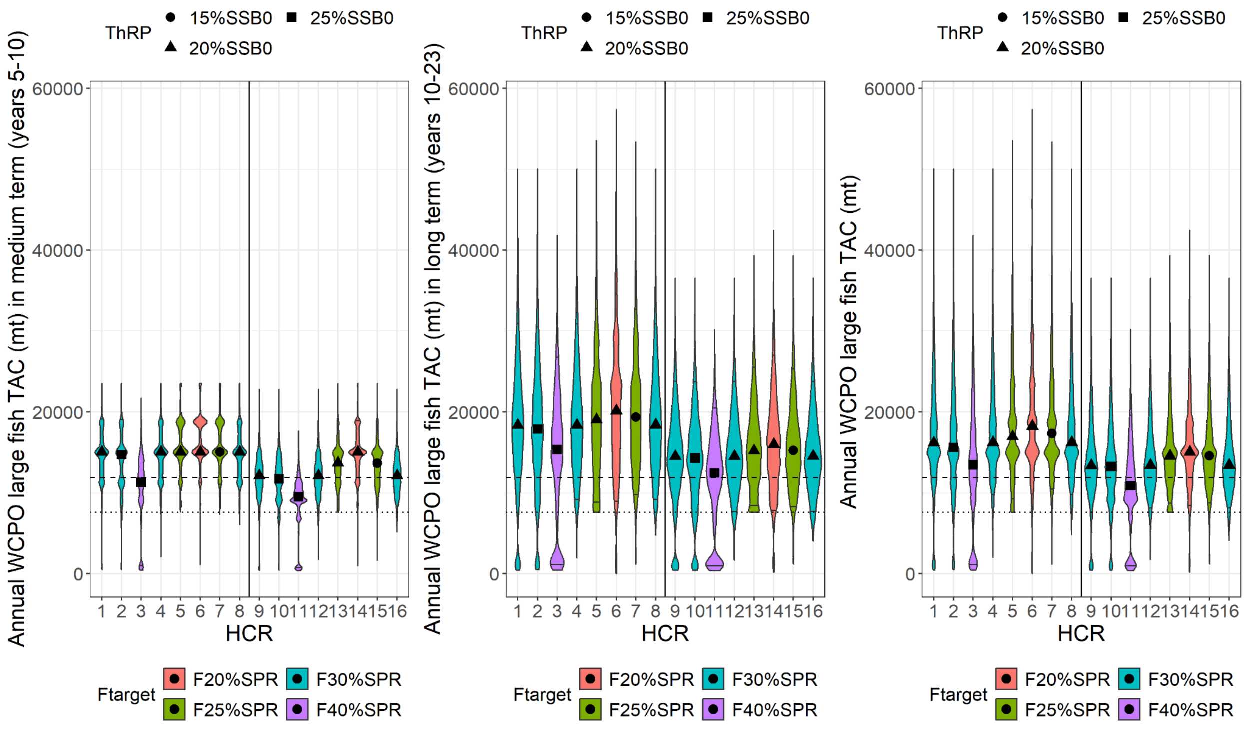

Figure 6-10 Violin plots showing the probability density of the TAC for the Western Central Pacific Ocean (WCPO) large fish fleets for each harvest control rule (HCR) across all iterations, reference scenarios, and simulation years in the medium term (first panel), long term (second panel), and annually (third panel). The medium term shows the annual catch distribution over years 5 to 10 of the simulation, while the long term shows the distribution over years 10 to 23 of the simulation. Colors represent the FTARGET reference point associated with each HCR. The marker inside each violin plot is the median value for the medium term, long term, or annual TAC, and horizontal solid lines within each violin represent the 5th to 95th quantile range. The shape of each marker represents the ThresholdRP (ThRP), which is the first control point for each HCR and stands for Threshold Reference Point. The dotted line identifies the catch limit for large fish set by the WCPFC's CMM 2023-02, effective in 2024. The dashed line identifies the catch limit for large fish set by the WCPFC's CMM 2024-01, effective in 2025. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean.

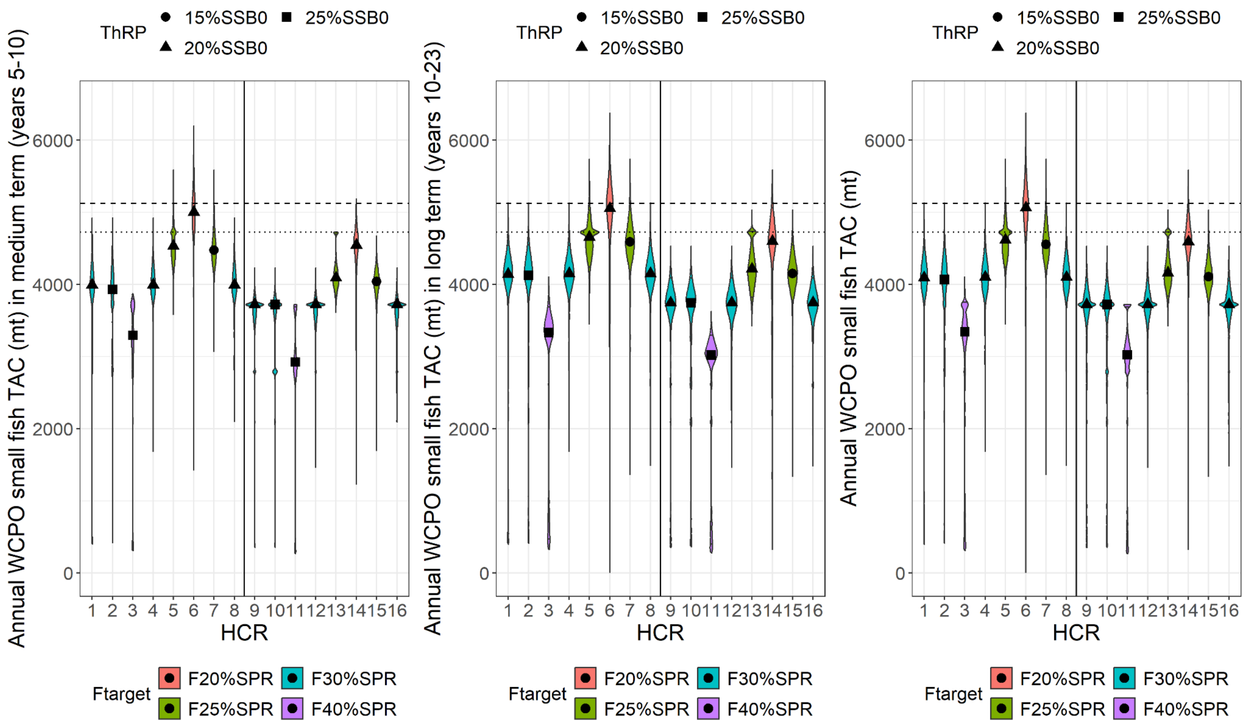

Figure 6-11 Violin plots showing the probability density of the TAC for the Western Central Pacific Ocean (WCPO) small fish fleets for each harvest control rule (HCR) across all iterations, reference scenarios, and simulation years in the medium term (first panel), long term (second panel), and annually (third panel). The medium term shows the annual catch distribution over years 5 to 10 of the simulation, while the long term shows the distribution over years 10 to 23 of the simulation. Colors represent the FTARGET reference point associated with each HCR. The marker inside each violin plot is the median value for the medium term, long term, or annual TAC, and horizontal solid lines within each violin represent the 5th to 95th quantile range. The shape of each marker represents the ThresholdRP (ThRP), which is the first control point for each HCR and stands for Threshold Reference Point. The dotted line identifies the catch limit for small fish set by the WCPFC's CMM 2023-02, effective in 2024. The dashed line identifies the catch limit for small fish set by the WCPFC's CMM 2024-01, effective in 2025. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean.

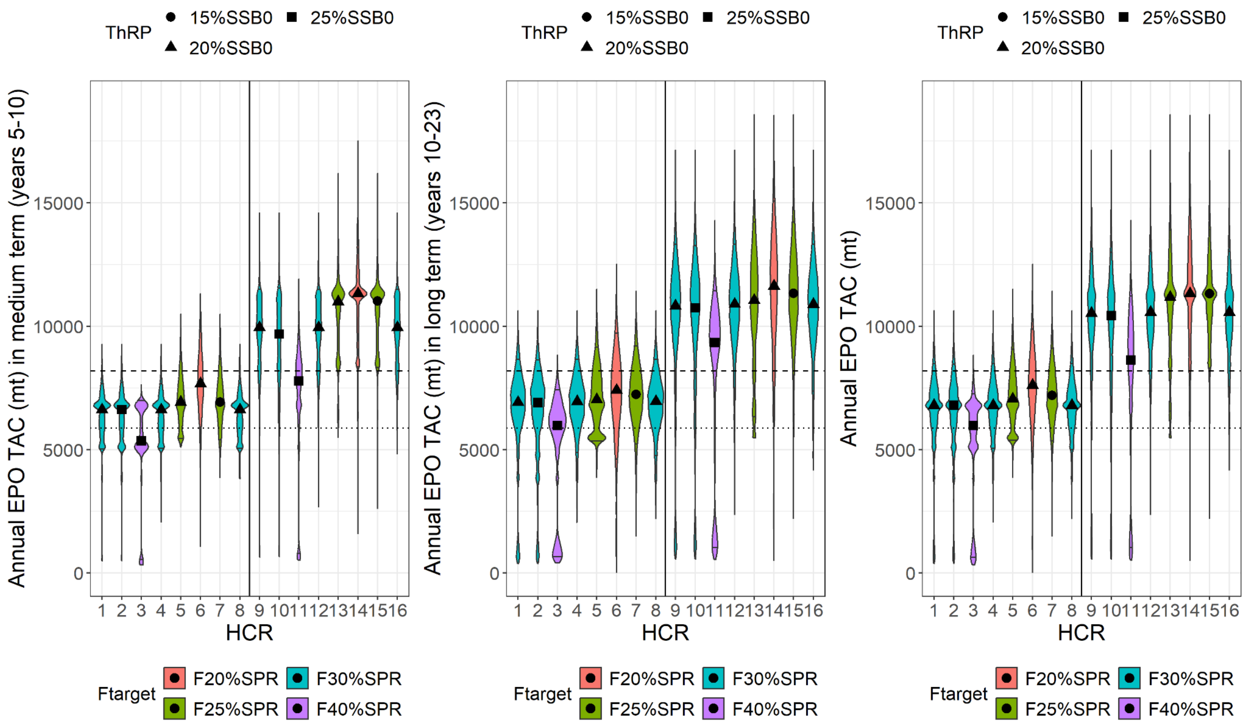

Figure 6-12 Violin plots showing the probability density of the TAC for the Eastern Pacific Ocean (EPO) fleets for each harvest control rule (HCR) across all iterations, reference scenarios, and simulation years in the medium term (first panel), long term (second panel), and annually (third panel). The medium term shows the annual catch distribution over years 5 to 10 of the simulation, while the long term shows the distribution over years 10 to 23 of the simulation. Colors represent the FTARGET reference point associated with each HCR. The marker inside each violin plot is the median value for the medium term, long term, or annual TAC and horizontal solid lines within each violin represent the 5th to 95th quantile range. The shape of each marker represents the ThresholdRP (ThRP), which is the first control point for each HCR and stands for Threshold Reference Point. The dotted line identifies the catch limit for the EPO set by IATTC's Resolution C-21-05, effective in 2024, plus EPO recreational catches for the calendar year 2023. The dashed line identifies the catch limit set by IATTC's Resolution C-24-02, effective in 2025, plus EPO recreational catches for the calendar year 2023. Catch limits were based on the half of the biennial TAC. Note that in the MSE, the EPO TAC includes recreational fleets. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70, but are otherwise the same as HCRs 1 to 8. WCPO stands for Western Central Pacific Ocean.

3. *Catch in the medium and long term for all HCRs is expected to be higher than the current catch limit, except for HCRs 3 and 11 in the medium term. However, the expected TAC trends differ among fleets, with only the WCPO large fish fleet and the EPO fleet under a 70:30 impact ratio increasing above current catch limits.*

Median catches of all HCRs, except for HCRs 3 and 11 in the medium term and across all years, reached higher levels than the current catch limit (Fig. ES9). All HCRs had a long term catch higher than the current catch limit (Fig. ES9). Across all HCRs, the increase in catch was due to increases in the WCPO large fish TAC, although the EPO TAC can be increased under a

70:30 impact ratio (Figs. ES10, ES11, and ES12). The WCPO large fish TAC was always higher than the current catch limits for all HCRs, except for HCRs 3 and 11 in the medium term and for HCR 11 across all years (Fig. ES10). The WCPO small fish TAC was always smaller than the current catch limits for all HCRs (Fig. ES11). The EPO TAC was larger only for HCRs 9 to 16, which had a higher EPO fisheries impact, with HCR 11 in the medium term being an exception (Fig. ES12). In the MSE, allocation of catch across the different fleet segments is set by the relative allocation of fishing mortality across fleets, which is set to the 2015-2022 baseline agreed upon by the JWG. These patterns are also affected by the fact that as the population biomass grows throughout the simulation, more biomass accumulates in older age classes, while average numbers of recruits and juveniles targeted by the WCPO small fish fleet segment and EPO may remain more stable. Furthermore, the TAC is dependent on estimates of numbers at age from the terminal year, which for young age classes are uncertain due to the lack of a recruitment or juvenile index. Thus, the estimation model tends to always estimate current recruitment to the average of the stock-recruitment function, leading to relatively low and stable small fish TACs.

4. *HCRs 1, 2, 3, 9, 10, and 11 had more instances of drastic (>25%) declines in catches due to severe management intervention resulting from breaching their respective LRP more often than other HCRs.*

HCRs 1, 2, 3, 9, 10, and 11 have longer lower tails in the annual catch violin plots in Fig. ES9, implying more instances of very low catch values. This is a result of more instances of severe management intervention due to their higher LRPs, which are breached more often than other HCRs. Indeed, worm plots of total TAC show that these HCRs have more instances where TAC declines dramatically (Fig. ES13) and these HCRs have the lowest 5th quantiles of TAC (Figs. ES9 and ES14).

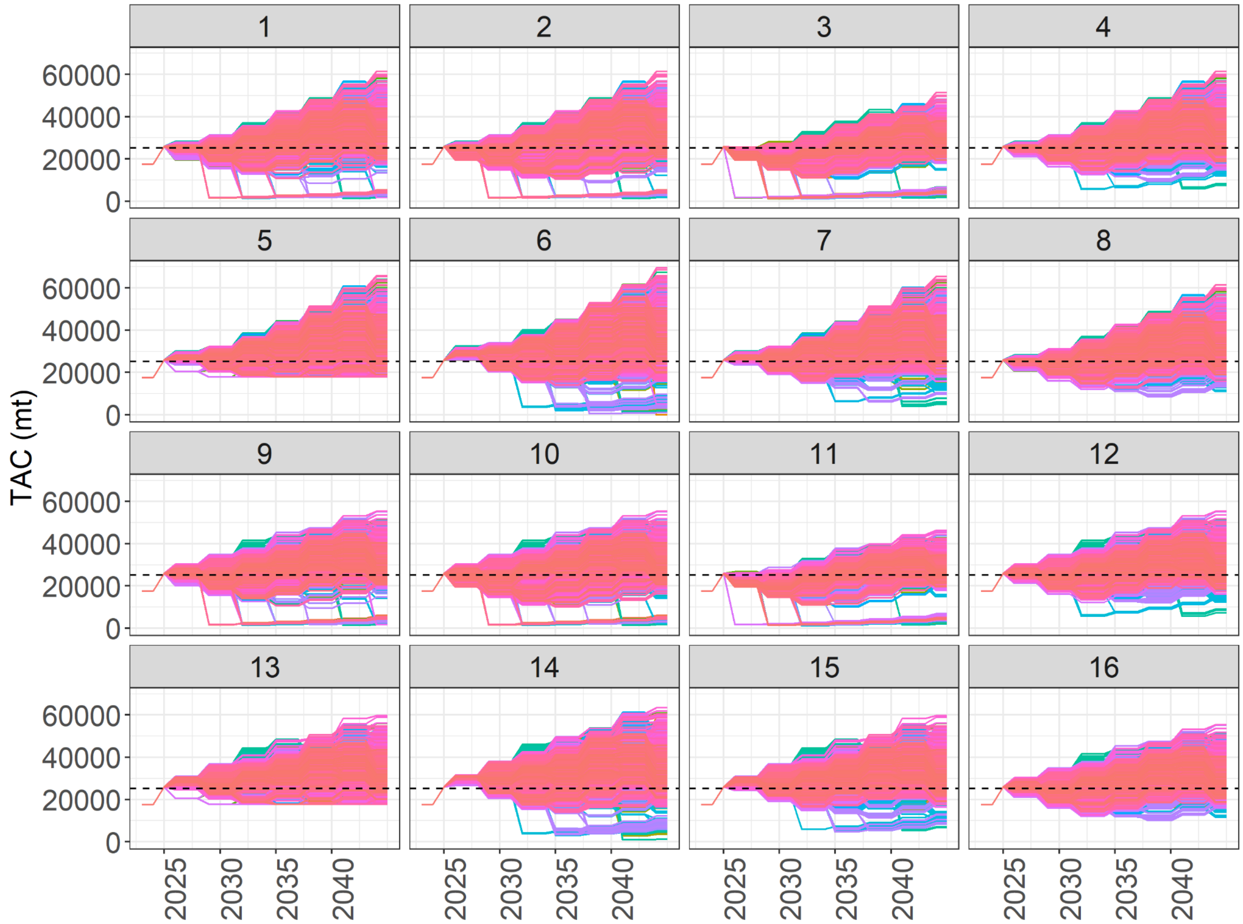

Figure 6-13 Worm plots of the total allowable catch (TAC) set by each harvest control rule (HCR) for individual runs across all reference scenarios. Each panel presents the results for the labeled HCR. Trajectories represent separate iterations differing in simulated random recruitment deviates. The dashed line represents the current catch limit set by the WCPFC's CMM 2024-01 and IATTC's Resolution C-24-02, plus EPO recreational catches for the calendar year 2023. For the IATTC's resolution, catch limits were based on half of the biennial TAC.

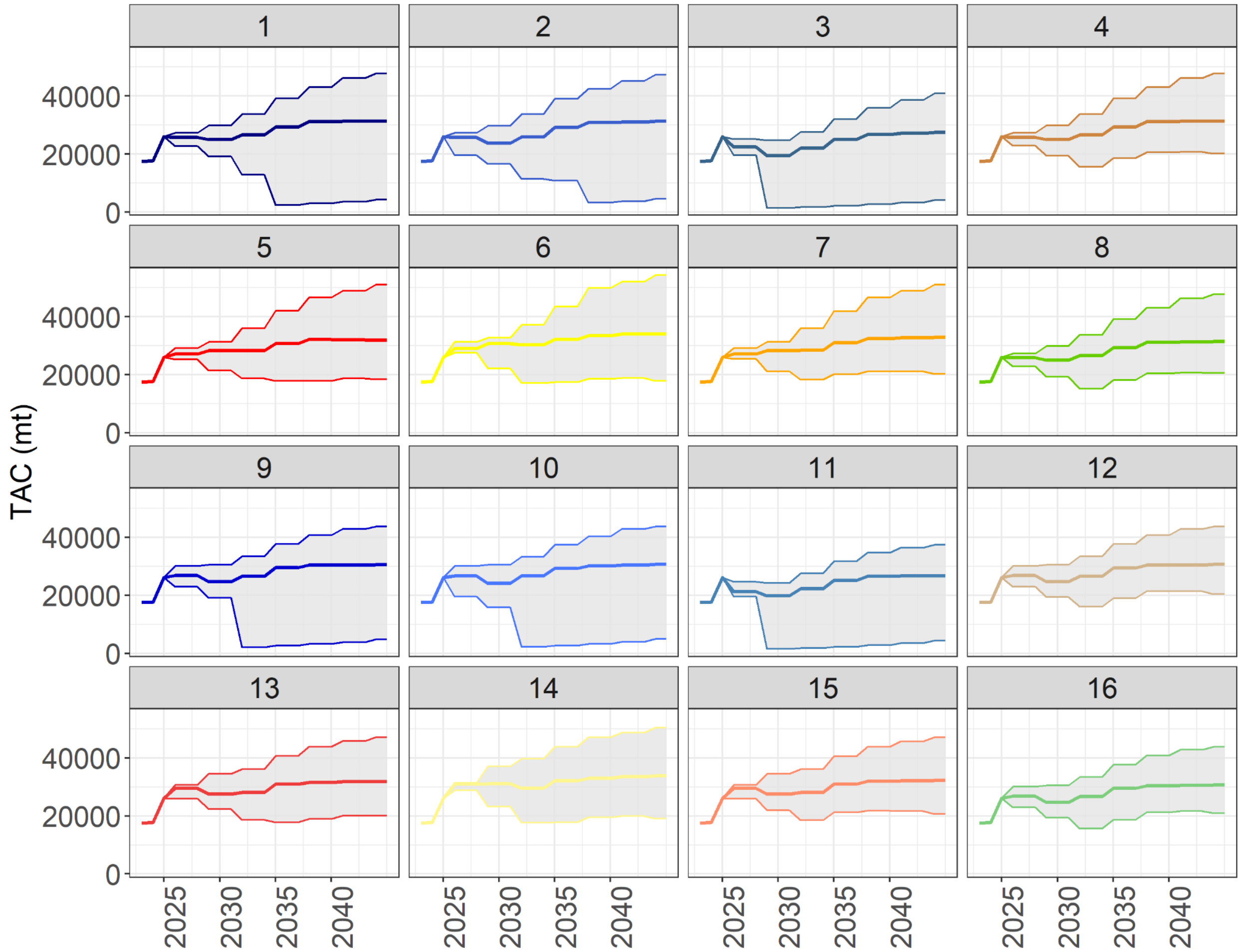

Figure 6-14 Trends in median total allowable catch (TAC) set by each harvest control rule (HCR) under all iterations and reference scenarios. The grey shading represents trends in the 5th to 95th quantiles of TAC.

5. HCRs with a first control point (i.e., ThRP) closer to the target SSB (SSB associated with their F_{TARGET}) had lower catch stability.

HCRs 2, 5, 6, 10, 13, and 14 have a first control point that is closer to the target SSB than other HCRs (Table ES2). This leads to more frequent large reductions in F and lower stability (Figs. ES15, ES16, Table ES4). HCRs 3 and 11 have the largest differences between their first control point and the SSB associated with their F_{TARGET} and have the highest catch stability when SSB is at or above the LRP (Figs. ES15, ES16, Table ES4). Nonetheless, due to the built-in 25% limit on TAC change in each HCR, all HCRs met the stability objective.

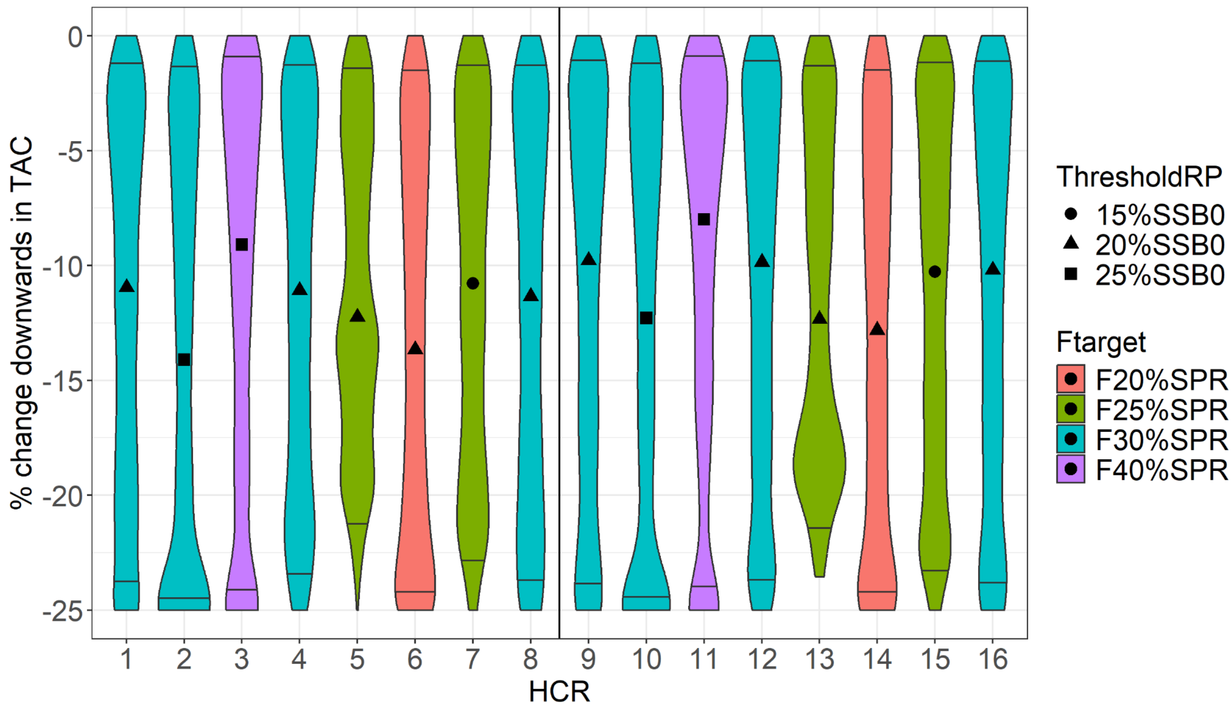

Figure 6-15 Violin plots showing the probability density of downward changes in TAC between management periods when SSB≥LRP for each harvest control rule (HCR) across all iterations, reference scenarios, and simulation years. Each HCR is colored according to their FTARGET. The marker inside each violin plot is the median downward change in TAC, and horizontal solid lines within each violin represent the 5th to 95th quantile range. Each symbol represents a different ThresholdRP, which is the first control point for each HCR and stands for Threshold Reference Point. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70, but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean and WCPO for Western Central Pacific Ocean.

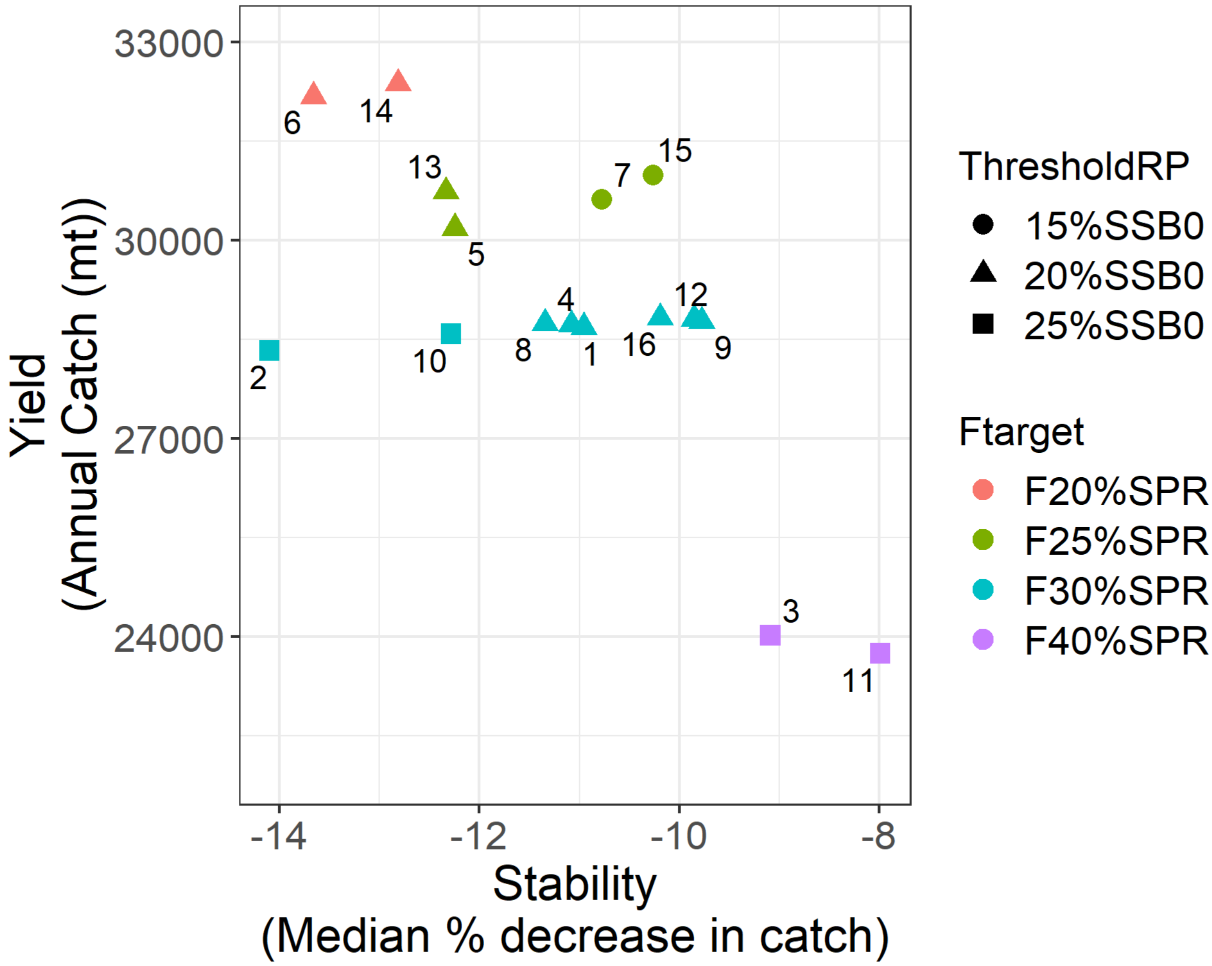

Figure 6-16 Median annual total catch versus the median decrease in catch between management periods. Each HCR is labeled colored according to their FTARGET. Each symbol represents a different ThresholdRP, which is the first control point for each HCR and stands for Threshold Reference Point.

6. *All HCRs met the status objective of maintaining fishing mortality at or below the F_{TARGET} with at least 50% probability.*

Despite uncertainties in stock productivity, recruitment variability, observation, estimation, and implementation, all HCRs met the status objective and maintained fishing mortality at or below the F_{TARGET} with at least 50% probability (Fig. ES17, Table ES4). For all HCRs, this probability was higher than 50% because the EM estimated fishing mortality as being lower than in the OMs, leading to a median F that was lower than the F_{TARGET} for all HCRs. The probability was highest for HCRs 1, 2, 3, 9, 10, and 11 because they had a higher LRP, resulting in drastic management interventions occurring more often. Once F fell to these low levels, it was slow to increase due to the 25% limit in TAC changes between management periods, even if biomass rebuilt quickly, leading to median F being lower.

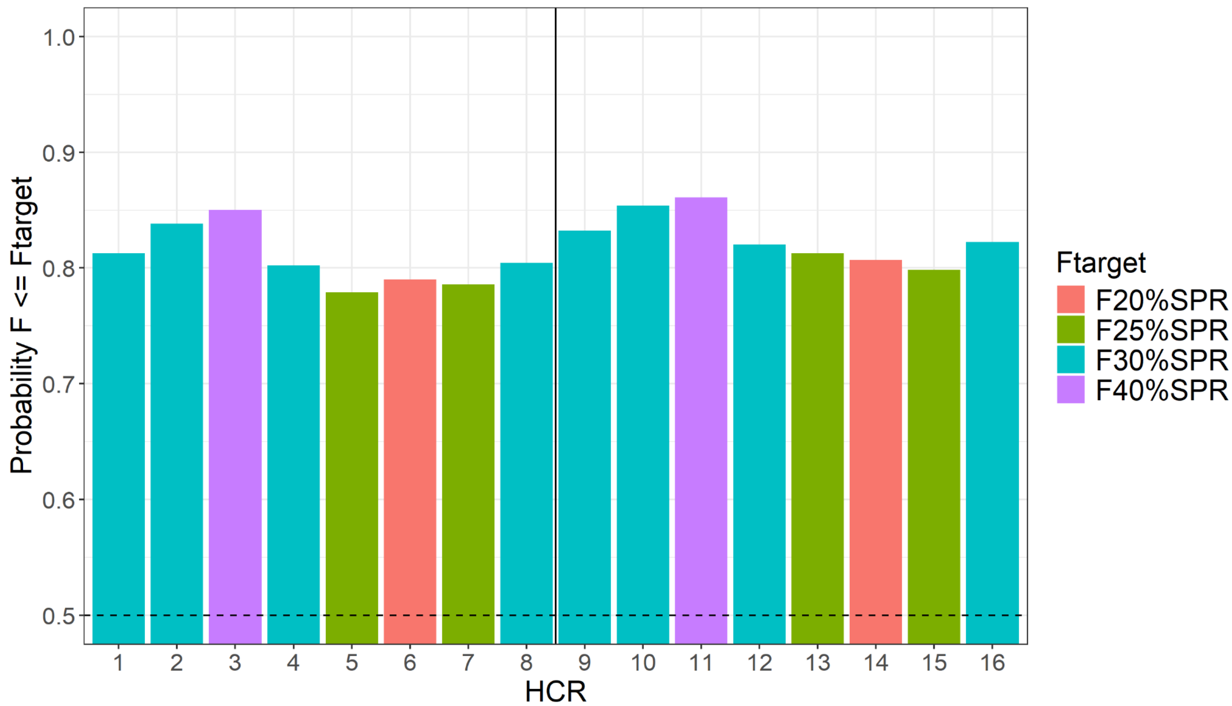

Figure **6-17** Plot of the first status performance metric, the probability, for each harvest control rule (HCR), of fishing mortality (F, 1-SPR) being less or equal to the FTARGET across all reference scenarios, iterations, and simulation years. Each HCR is colored according to their FTARGET. The horizontal dotted line represents a 50% probability. The vertical solid line separates HCRs 9 to 16, which are tuned to an EPO:WCPO impact ratio of 30:70 but are otherwise the same as HCRs 1 to 8. EPO stands for Eastern Pacific Ocean and WCPO for Western Central Pacific Ocean.

7. *The different fisheries impact ratios only affected yield metrics but other performance metrics remained almost unchanged.*

HCRs 1 to 8 maintained the current WCPO:EPO fisheries impact ratio (about 80:20), while HCRs 9 to 16 were tuned to meet a 70:30 ratio. We would then expect higher yields for EPO fleets and lower yields for WCPO fleets under HCRs 9 to 16 (Figs. ES7, ES8, and ES9). All other metrics remained quite similar (Table ES4). Other performance metrics remained almost unchanged as shown in various tables and figures.

8. *Under robustness tests, all HCRs were robust to discard and effort-creep uncertainty, but performance deteriorated under extreme drops (40%) in recruitment over a 10-year period.*

Under robustness tests, where HCRs faced more unlikely but still possible situations, the performance naturally deteriorated as they were placed in more extreme conditions. Nonetheless, all HCRs were fairly robust to the "doubling of the discards" scenario and the "effort-creep" scenario. However, although the degree was different among HCRs, all HCRs had difficulty in dealing with the "recruitment drop" scenario. This is expected because the MPs only respond to the assessed terminal SSB. Since PBF fully mature at 5 years of age and the abundance trend was informed only by the longline CPUE index, which informs the relative biomass of age 7 and older, it takes several years for the EM to detect a decline in SSB from the recruitment drop and for the MPs to initiate a significant reduction in catches. In the meantime, small fish catches remain an important component of the fishing mortality. Once the EM eventually detected the decrease in SSB, F was curtailed, and median SSB ultimately rebuilt to target levels for all HCRs. It is therefore important to carefully monitor the recruitment and also SSB through regular assessments to detect in a timely manner if a chronic decline in recruitment has occurred and to consider appropriate exceptional circumstances provisions to swiftly deal with such a situation. For more details, see the main body of the report.

Key Limitations

- Fleet selectivity was assumed to be constant at the current average of 2015-2022 levels throughout the simulation. If fleet operations and targeting behavior change in the future so that the size composition of catch of specific fleets differs widely from what was simulated, results from this analysis may no longer be applicable.
- The operating models were conditioned on data from 1983 onwards, thus the management procedures tested here are robust to uncertainty in productivity that was bounded by those historical observations. If future population dynamics strongly diverge from the past, results from this analysis may no longer be applicable.

Table 6-4 Performance indicators for each harvest control rule (HCR) across all iterations, evaluation years, and operating models. SSB refers to spawning stock biomass, LRP to limit reference point, SSBF=0 refers to unfished spawning stock biomass, F refers to fishing mortality measured as 1-SPR where SPR is spawning potential ratio, TAC refers to total allowable catch, WCPO refers to Western Central Pacific Ocean and EPO refers to Eastern Pacific Ocean. Note that to ensure that for all indicators a higher value is better, here we reversed the performance metrics showed in Figures ES5 and ES7 to be the probability of SSB≥LRP and of SSB≥20%SSBF=0. The % change upwards in TAC (% change TAC +) was set to negative so that high values (smaller -) are better. The % change downwards does not include years when SSB is below LRP as provided by the management objective. The value including years when SSB is below LRP is provided in the main body of the report. The 2026 TAC is the total TAC and the TAC for each fleet segment that could be applied in 2026 if each of the HCR would be adopted. It is calculated based on biomass status estimated by EM. Color shadings reflect the range of each column. Highest levels have dark green, lowest light yellow, and different shades of green to yellow are in between. As there is no optimal impact, the EPO impact column does not have a color.

Performance Indicators

Reference Set

	Prob SSB => LRP	Prob SSB => 20%SSBo	Prob F <= Ftarget	Prob SSB => SSBtarget	% change TAC +	% change TAC -	EPO Impact	Median annual catch	Median years 5-10 annual catch	Median years 11-23 annual catch	Median WCPO large fish annual TAC	Median WCPO small fish annual TAC	Median EPO annual TAC	2026 TAC	2026 TAC WCPO large fish	2026 TAC WCPO small fish	2026 TAC EPO
1	93	87	81	62	-14	-11	23	28685	26744	31094	16174	4093	6794	25868	14836	4512	6520
2	94	87	84	64	-15	-14	23	28330	26054	30691	15618	4069	6794	25868	14836	4512	6520
3	91	91	85	56	-17	-9	24	24026	21135	26361	13472	3346	5971	24366	14836	3844	5686
4	99	86	80	61	-13	-11	23	28722	26745	31124	16221	4102	6794	25868	14836	4512	6520
5	100	81	78	66	-13	-12	22	30183	28894	32227	16965	4617	7054	27485	14836	5161	7488
6	99	76	79	76	-14	-14	22	32174	31286	34249	18243	5063	7609	29437	14836	5939	8662
7	100	82	79	67	-13	-11	23	30616	28940	32814	17330	4557	7192	27485	14836	5161	7488
8	100	86	80	61	-14	-11	23	28741	26746	31127	16222	4101	6794	25868	14836	4512	6520
9	93	86	83	63	-13	-10	32	28773	26503	30537	13378	3722	10528	27942	14073	4392	9476
10	93	87	85	65	-16	-12	32	28582	25973	30368	13242	3722	10433	27942	14073	4392	9476
11	91	91	86	56	-16	-8	32	23748	21378	26147	10877	3023	8632	23653	10724	3844	9085
12	99	86	82	62	-12	-10	33	28812	26505	30572	13414	3722	10568	27942	14073	4392	9476
13	100	82	81	68	-13	-12	30	30735	29380	31768	14567	4160	11175	29323	14836	5010	9476
14	99	77	81	77	-15	-13	31	32369	32077	33617	15040	4592	11323	30061	14836	5749	9476
15	100	81	80	67	-12	-10	32	30988	29413	32137	14567	4108	11323	29323	14836	5010	9476
16	100	86	82	62	-12	-10	33	28826	26507	30582	13413	3722	10565	27942	14073	4392	9476

Discussion

The Plenary expressed appreciation for the extensive work to complete the MSE, including coordination with stakeholders and managers and the development of a user-friendly Shiny application to visualize results. Elements of the MSE were discussed in further detail, including constraints on total allowable catch (TAC), the use of biological assumptions such as growth variability, and the application of harvest control rules (HCRs). Clarification was provided that the 25% TAC change limit was based on JWG management guidance and not altered by the scientists. Further details were provided on the structure of the MSE outputs, which allocate TAC by broad fleet segments (e.g., EPO/WCPO, large/small fish), not by country, per direction from the JWG. The selected harvest control rules were based on manager preferences, as requested by the JWG. A request was made to add language to the report acknowledging that new CMM provisions for Southern Hemisphere bycatch allowances (NZ, AUS) were not considered in the MSE. There were also a number of questions regarding the potential incorporation of environmental and distributional shifts (e.g. due to changing climates) into the MSE process. While not included in this round, such factors were recognized as important for future iterations. It was agreed that future review of the adopted management procedure (MP) should follow precedent set by other RFMOs, with formal review is expected to be scheduled after several years of implementation. **ISC25 endorsed the PBF MSE results and agreed that they be presented at relevant meetings.**

7 PACIFIC BLUEFIN TUNA ASSESSMENT REVIEW

The peer review of the 2024 PBF stock assessment is scheduled for March 20, 2026. The PBFWG expressed appreciation to the U.S. government for its generous funding, which made the review possible.

The PBFWG has developed a draft Terms of Reference (ToR) for the review, and has shared a draft with ISC members. The objective of the review is to evaluate the PBF assessment to ensure it provides sound scientific advice to managers, and to recommend improvements for future assessments. The six main elements of the ToR items include:

1. Review of biological assumptions
2. Review of data
3. Review of model configurations
4. Review of diagnostics and results
5. Suggestions for future research priorities
6. Assessment of clarity and presentation of results

Reviewers will submit a summary report at the end of the session and a final report within one month. For reviewer selection, members will be invited to submit nominations, which will be ranked and reviewed by ISC, alongside any suggestions from WCPFC. Selected reviewers will be contacted to confirm availability, and a Chair for the review will be identified, either from the reviewers or by the ISC Chair. The process is expected to be finalized by late summer 2025.

The PBFWG requested comments from ISC members on the draft ToR by July 31, 2025. Comments should be sent to the PBF and ISC Chairs.

8 STOCK STATUS AND CONSERVATION INFORMATION

8.1 North Pacific Albacore

S. Hawkshaw, ALBWG Chair, noted that the last stock assessment was conducted in 2023, and the next assessment is planned for 2026 and they recommended the stock status and conservation information for NPO ALB presented at ISC23. The ISC25 Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC23, which was based on the 2023 stock assessment (see Section 6.1.2, pp. 17-27 in the **ISC23 Plenary Report**) with minor updates and the omission of accompanying figures and tables.

8.1.1 Stock Status and Conservation Information

Stock Status

Estimated summary biomass (males and females at age-1+) declined at the beginning of the time series until 2004. Subsequently, the summary biomass fluctuated without a trend until 2018, after which the biomass rapidly increased to historically high levels. It should be noted that the high summary biomass estimates during 2018-2021 were highly uncertain and should be treated with caution. These high summary biomass estimates were due to historically high recruitment estimates in 2017 (~433 million fish; 95% CI: 194 – 671 million fish). However, recruitment estimates in the last 5 years (2017-2021) were highly uncertain and should be treated with caution. Estimated female SSB exhibited a similar population trend to the summary biomass, albeit with a lag of several years, and showed an initial decline until 2007 followed by fluctuations without a clear trend through 2021.

The average fishing intensity during 2018-2020 was estimated to be $F_{59\%SPR}$ (95% CI: $F_{72\%SPR}$ – $F_{46\%SPR}$), which was relatively moderate and resulted in a population with an SPR of approximately 59%. Instantaneous fishing mortality at age (F-at-age) was similar in both sexes through age-5, peaking at age-4 and declining to a low at age-6, after which males experienced higher F-at-age than females up to age 12. Juvenile albacore aged 2 to 4 years comprised approximately 64% of the annual catch-at-age in numbers between 1994 and 2021 due to the larger impact of surface fisheries (primarily troll, pole-and-line), which remove juvenile fish, relative to longline fisheries, which primarily remove adult fish.

Stock status is depicted in relation to the target ($F_{45\%SPR}$), threshold ($30\%SSB_{current,\ F=0}$), and limit ($14\%SSB_{current,\ F=0}$) reference points. The estimated female SSB has never fallen below the threshold and limit reference points since 1994, albeit with large uncertainty in the terminal year (2021) estimates. However, the estimated fishing intensity for 5 years (1999, 2002, 2003, 2004, and 2007) exceeded the target reference point. Even when alternative hypotheses about key model uncertainties such as growth were evaluated, the point estimate of female SSB in 2021 (SSB_{2021}) did not fall below the threshold and limit reference points, although the risk increases with the more extreme assumption. In contrast, estimated average fishing intensity during 2018-

2020 ($F_{2018\text{-}2020}$) did exceed the target reference point under one of these alternative hypotheses but did not exceed the average fishing intensity during the 2002-2004 period.

The SSB_{2021} was estimated to be approximately 54% (95% CI: 40 – 68%) of $SSB_{current,\ F=0}$ and 1.8 (95% CI: 1.3 – 2.3) times greater than the estimated threshold reference point (Figure 6; Table 1). The estimated current fishing intensity ($F_{2018\text{-}2020}$) was estimated to be $F_{59\%SPR}$ (95% CI: $F_{72\%SPR}$ – $F_{46\%SPR}$) and was lower than both the $F_{45\%SPR}$ target reference point and the average fishing intensity during the 2002-2004 period.

Based on these findings, the following information on the status of the NPO ALB stock is provided by the ISC25 Plenary:

1. **The stock is likely not overfished relative to the threshold (30%$SSB_{current,\ F=0}$) and limit (14%$SSB_{current,\ F=0}$) reference points adopted by the WCPFC and IATTC in their harvest strategies (WCPFC Harvest Strategy 2023-01; IATTC Resolution C-23-02);**
2. **The stock is likely not experiencing overfishing relative to the adopted target reference point ($F_{45\%SPR}$), which is the fishing intensity that results in the stock producing a SPR of approximately 45%; and**
3. **Current fishing intensity ($F_{2018\text{-}2020}$) is lower than the average fishing intensity from the 2002-2004 period (the reference level for IATTC Resolution C-05-02 and WCPFC CMM 2019-03).**

<u>**Conservation Information**</u>

Two harvest scenarios were projected to evaluate impacts on the management objectives of the IATTC and WCPFC for this stock: 1) maintain SSB above the limit reference point, with a probability of at least 80% over the next 10 years; 2) maintain depletion of total biomass around the historical (2006-2015) average depletion over the next 10 years; and 3) maintain fishing intensity at or below the target reference point with a probability of at least 50% over the next 10 years (WCPFC HS 2023-01; IATTC Resolution C-23-02). As a larger cohort is estimated in the latest period of the assessment, all projections show a steep increase of SSB in the first year.

The constant fishing intensity scenario showed that the current fishing intensity ($F_{2018\text{-}2020}$) is expected to result in female SSB increasing to 90,098 t (95% CI: 23,218 – 156,978 t) by 2031. Over the next 10 years, there was: 1) a 97.7% probability of the female SSB remaining above the 14%$SSB_{current,\ F=0}$ LRP for all 10 years; 2) a 72.0% probability of the total biomass (age-1+) being above the average of 2006-2015 for any year; and 3) a 95.5% probability of the fishing intensity remaining at or below the $F_{45\%SPR}$ TRP for any year.

The randomly resampled fishing intensity scenario showed that when future fishing intensity is similar to the 2005 – 2019 period, female SSB is expected to increase to 87,669 t (95% CI: 22,219 – 153,119 t) by 2031. Over the next 10 years, there was: 1) a 98.1 % probability of the female SSB remaining above the 14%$SSB_{current,\ F=0}$ LRP for all 10 years; 2) a 69.5 % probability of the total biomass (age-1+) being above the average of 2006 – 2015 for any year; and 3) a 79.6 % probability of the fishing intensity remaining at or below the $F_{45\%SPR}$ TRP for any year.

Based on these findings, the following conservation information is provided by the ISC25 Plenary for the NPO ALB stock:

1. **If fishing intensity over the next 10 years is maintained at the current fishing intensity ($F_{2018-2020}$), then female SSB is expected to remain around 54%$SSB_{current,F=0}$ (90,098 t), with a 97.7% probability that female SSB will remain above the 14%$SSB_{current, F=0}$ LRP for all 10 years and the harvest strategy management objectives in the IATTC and WCPFC harvest strategies (IATTC Resolution C-23-02; WCPFC Harvest Strategy 2023-01) will likely be met; and**
2. **If fishing intensity over the next 10 years is similar to the 2005 – 2019 period, then female SSB is expected to decrease to 52%$SSB_{current, F=0}$ (87,669 t), with a 98.1 % probability that female SSB will remain above the 14%$SSB_{current, F=0}$ LRP for all 10 years and the harvest strategy management objectives of the IATTC and WCPFC (IATTC Resolution C-23-02; WCPFC Harvest Strategy 2023-01) will likely be met.**

8.2 Pacific Bluefin Tuna Stock Status and Conservation Information

S. Nakatsuka, PBFWG Chair, noted that the last stock assessment was conducted in 2024, and the next assessment is planned for 2027 and they recommended the stock status and conservation information for PBF presented at ISC24 with minor updates and the omission of accompanying figures and tables. The ISC25 Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC24, which was based on the 2024 stock assessment (see Section 6.2.2, pp. 26-28 in the **ISC24 Plenary Report**).

8.2.1 Stock Status and Conservation Information

The base-case model results show that: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1983-2022); (2) the SSB steadily declined from 1996 to 2010; (3) the SSB has rapidly increased since 2011; (4) fishing mortality ($F_{\%SPR}$) decreased from a level producing about 1% of SPR[2] in 2004-2009 to a level producing 23.6% of SPR in 2020-2022; and (5) SSB in 2022 increased to 23.2% of $SSB_{F=0}$[3], achieving the second rebuilding target by WCPFC and IATTC in 2021. Based on the model diagnostics, the estimated biomass trend throughout the assessment period is considered robust. The SSB in 2022 was estimated to be 144,483 t (Table 1 and Figure 6), more than 10 times of its historical low in 2010. An increase in immature fish (0-3 years old) is observed in 2016-2019, likely resulting from reduced fishing mortality on this age group. This led to a substantial increase in SSB after 2019. The method to estimate confidence interval was changed from bootstrapping in the previous assessments to normal approximation of the Hessian matrix.

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[2] SPR (spawning potential ratio) is the ratio of the cumulative spawning biomass that an average recruit is expected to produce over its lifetime when the stock is fished at the current fishing level to the cumulative spawning biomass that could be produced by an average recruit over its lifetime if the stock was unfished. $F_{\%SPR}$: F that produces % of the spawning potential ratio (i.e., 1-%SPR).

[3] SSBF=0 is the expected spawning stock biomass under average recruitment conditions without fishing.

Historical recruitment estimates have fluctuated since 1983 without an apparent trend. Stock projections assume that future recruitment will fluctuate around the historical (1983-2020 FY) average recruitment level. Previously, no significant autocorrelation was found in recruitment estimates, supporting the use of randomly resampled recruitment from the historical time series. In addition, now that SSB has recovered to 23.2%$SSB_{F=0}$, the PBFWG considers the assumption that the future recruitment will fluctuate within the historical range to be reasonable. The PBFWG also confirmed that the distributions of historical recruitment from the updated long-term model (1952-2022) and the present base-case model (1983-2022) are comparable.

Stock Status

PBF spawning stock biomass (SSB) has increased substantially in the last 12 years. These biomass increases coincide with a decline in fishing mortality, particularly for fish aged 0 to 3, over the last decade. The latest (2022) SSB is estimated to be 23.2% of $SSB_{F=0}$ and the probability that it is above 20%$SSB_{F=0}$ is 75.9%. **Based on these findings, the following information on the status of the PBF stock is provided by the ISC25 Plenary**:

1. **No biomass-based limit or target reference points have been adopted for PBF, but the PBF stock is not overfished relative to 20%$SSB_{F=0}$, which has been adopted as a biomass-based reference point for some other tuna species by the IATTC and WCPFC. SSB of PBF reached its initial rebuilding target (SSB_{MED} = 6.3%$SSB_{F=0}$) in 2017, seven years earlier than originally anticipated by the RFMOs, and its second rebuilding target (20%$SSB_{F=0}$) in 2021; and**
2. **No fishing mortality-based reference points have been adopted for PBF by the IATTC and WCPFC. The recent (2020-2022) F%SPR is estimated to be 23.6% and thus the PBF stock is not subject to overfishing relative to some of F-based reference points proposed for tuna species, including F20%SPR.**

Conservation Information

After the steady decline in SSB from 1996 to the historically low level in 2010, the PBF stock has started recovering, and recovery has been more rapid in recent years, coinciding with the implementation of stringent management measures. The 2022 SSB was 10 times higher than the historical low and is above the second rebuilding target adopted by the WCPFC and IATTC, which was achieved in 2021. The stock has recovered at a faster rate than anticipated when the Harvest Strategy to foster rebuilding (WCPFC HS 2017-02) was implemented in 2014. The fishing mortality (F%SPR) in 2020-2022 is at a level producing 23.6%SPR. According to the requests from WCPFC and IATTC, future projections under various scenarios were conducted. The projection scenarios and their results, including projected yield are shown in Tables 3, 4, and 5 and Figure 14. In addition, the results of additional projections which were requested by the IATTC-WCPFC NC JWG are provided in Appendix 2 of the stock assessment report (**ISC/24/ANNEX/13**).

Based on these findings, the following information on the conservation of the PBF stock is provided by the ISC25 Plenary:

1. **The PBF stock is recovering from the historically low biomass in 2010 and has exceeded the second rebuilding target (20%$SSB_{F=0}$). The risk of SSB falling below 7.7%$SSB_{F=0}$ (interim LRP for tropical tunas in IATTC) at least once in 10 years is negligible;**
2. **The projection results show that increases in catches are possible. However, the risk of falling below the second rebuilding target will increase with larger increases in catch;**
3. **The projection results assume that the CMMs are fully implemented and are based on certain biological and other assumptions. For example, these future projection results do not contain assumptions about discard mortality. Discard mortality may need to be considered as part of future increases in catch; and**
4. **Given the uncertainty in future recruitment and the influence of recruitment on stock biomass as well as the impact of changes in fishing operations due to the management, monitoring recruitment and SSB should continue. Research on a recruitment index for the stock assessment should be pursued, and maintenance of a reliable adult abundance index should be ensured. In addition, accurate catch information is the foundation of good stock assessment.**

8.3 Blue Shark

M. Kinney, SHARKWG Chair, noted that the last stock assessment was conducted in 2022, and the next assessment is planned for 2027 and they recommended the stock status and conservation information for NPO BSH presented at ISC22 and carried forward in subsequent Plenary meetings. The ISC25 Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC22, which was based on the 2022 stock assessment (see Section 6.3.1 pp. 52-54 in the ISC22 Plenary Report).

8.3.1 Stock Status and Conservation Information

Stock status

The median of the annual spawning stock biomass (SSB) from the model ensemble had a steadily decreasing trend until 1992 and a slightly increasing trend until recent years. The median of the annual F from the model ensemble gradually increased in the late 1970s and 1980s and suddenly dropped around 1990, which slightly preceded the high-seas drift gillnet fishing ban, after which it has been slightly decreasing. The median of the annual age-0 recruitment estimates from the model ensemble appeared relatively stable with a slightly decreasing trend over the assessment period except for 1988, which shows a large pulse. The historical trajectories of stock status from the model ensemble revealed that North Pacific BSH had experienced some level of depletion and overfishing in previous years, showing that the trajectories moved through the overfishing zone, overfished and overfishing zone, and overfished zone in the Kobe plots relative to MSY-based reference points. However, in the last two decades, median estimates of the stock condition returned to the bottom-right quadrant of the Kobe plot.

Based on these findings, the following information on the status of the NPO BSH stock is provided by the ISC25 Plenary:

1. **Target and limit reference points have not been established for pelagic sharks in the Pacific Ocean. Stock status is reported in relation to MSY-based reference points;**

2. **Median female SSB in 2020 (SSB_{2020}) was estimated to be 1.170 of SSB_{MSY} (80th percentile, 0.570 - 1.776) and is likely not (63.5% probability) in an overfished condition relative to MSY-based reference points;**

3. **Recent annual F ($F_{2017-2019}$) is estimated to be below F_{MSY} and overfishing of the stock is very likely (91.9% probability) not occurring relative to MSY-based reference points; and**

4. **The base case model results show that there is a 61.9% joint probability that NPO BSH stock is not in an overfished condition and that overfishing is not occurring relative to MSY-based reference points.**

<u>Conservation information</u>

Stock projections of biomass and catch of NPO BSH from 2020 to 2030 were performed assuming four different harvest policies: $F_{current}$ (2017-2019), F_{MSY}, $F_{current}$+20%, and $F_{current}$-20% and evaluated relative to MSY-based reference points.

Based on these findings, the following conservation information for NPO BSH is provided by the ISC22 Plenary:

1. **Future projections in three of the four harvest scenarios ($F_{CURRENT}$ (2017-2019), $F_{CURRENT}$+20%, and Fcurrent-20%) showed that median BSH SSB in the NPO will likely increase (>50% probability); the F_{MSY} harvest scenario led to a decrease in median SSB.**

2. **Median estimated SSB of BSH in the NPO will likely (>50 probability) remain above SSB_{MSY} in the next 10 years for all scenarios except F_{MSY}; harvesting at F_{MSY} decreases SSB below SSB_{MSY}; and**

3. **There remain some uncertainties in the time series based on the quality (observer versus logbook) and timespans of catch and relative abundance indices, limited size composition data for several fisheries, the potential for additional catch not accounted for in the assessment, and uncertainty regarding life history parameters. Continued improvements in the monitoring of BSH catches, including recording the size and sex of sharks retained and discarded for all fisheries, as well as continued research into the biology, ecology, and spatial structure of BSH in the North Pacific Ocean are recommended.**

Special Note

1. The SHARKWG notes that uncertainty in stock status in the current assessment is likely still underrepresented as the model ensemble did not consider key uncertainties such as natural mortality or stock-recruitment resilience which are not well-known for many shark species.

8.4 Shortfin Mako Shark

M. Kinney, SHARKWG Chair noted that the last stock assessment was conducted in 2024, and the next assessment is planned for 2029 and they recommended the stock status and conservation information for NPO SMA presented at ISC24. The ISC25 Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC24, which was based on the 2024 stock assessment (ISC24 Plenary Report see Section 6.4.3 pp. 46-48).

8.4.1 Stock Status and Conservation Information

Stock Status

The current assessment provides the best scientific information available on North Pacific shortfin mako shark (SMA) stock status. Results from this assessment should be considered with respect to the management objectives of the WCPFC and the IATTC, the organizations responsible for management of pelagic sharks caught in international fisheries for tuna and tuna-like species in the Pacific Ocean. Target and limit reference points have not been established for pelagic sharks in the Pacific Ocean. In this assessment, stock status is reported in relation to maximum sustainable yield (MSY).

A BSPM ensemble was used for this assessment; therefore, the reproductive capacity of this population was characterized using total depletion (D) rather than spawning abundance as in the previous assessment. Total depletion is the total number of SMA divided by the unfished total number (i.e., carrying capacity). Recent D ($D_{2019-2022}$) was defined as the average depletion over the period 2019-2022. Exploitation rate (U) was used to describe the impact of fishing on this stock. The exploitation rate is the proportion of the SMA population that is removed by fishing. Recent U ($U_{2018-2021}$) is defined as the average U over the period 2018-2021.

During the 1994-2022 period, the median D of the model ensemble in the initial year D_{1994} was estimated to be 0.19 (95% CI: credible intervals = 0.08-0.44), and steadily improved over time and $D_{2019-2022}$ was 0.60 (95% CI = 0.23-1.00). Although there are large uncertainties in the estimated population scale, the best available data for the stock assessment are four standardized abundance indices from the longline fisheries of Japan, Taiwan, and the US; and all four indices indicate a substantial (>100%) increase in the population during the assessment period. The population was likely heavily impacted prior to the start of the modeled period (1994), after which it has been steadily recovering. It is hypothesized that the fishing impact prior to the modeled period was likely due to the high-seas drift gillnet fisheries operating from the late 1970s until it was banned in 1993, though specific impacts from this fishery on SMA are uncertain as species specific catch data are not available for sharks. Consistent with the estimated trends in depletion, the exploitation rates were estimated to be gradually decreasing from 0.023

(95% CI = 0.004-0.09) in 1994 to the recent estimated exploitation rate ($U_{2018-2021}$) of 0.018 (95% CI = 0.004-0.07). The decreasing trends in estimated exploitation rates were likely due to the increase in estimated population size being greater than increases in the observed catch.

The median of recent D ($D_{2019-2022}$) relative to the estimated D at MSY (D_{MSY} = 0.51, 95% CI = 0.40-0.70) was estimated to be 1.17 (95% CI = 0.46-1.92). The recent median exploitation rate ($U_{2018-2021}$) relative to the estimated exploitation rate at MSY (U_{MSY} = 0.05, 95% CI =0.03-0.09) was estimated to be 0.34 (95% CI = 0.07-1.20). Surplus production models are a simplification of age-structured population dynamics and can produce biased results if this simplification masks important components of the age-structured dynamics (e.g., index selectivities are dome shaped or there is a long time-lag to maturity). Simulations suggest that under circumstances representative of the observed SMA fishery and population characteristics (e.g., dome-shaped index selectivity, long lag to maturity, and increasing indices), the BSPM ensemble may produce biased results. Representative simulations suggested that the $D_{2019-2022}$ estimate has a positive bias of approximately 7.3 % (median). The trajectories of stock status from the model ensemble revealed that North Pacific SMA had experienced a high level of depletion prior to the start of the model and was likely overfished in the 1990s and 2000s, relative to MSY reference points.

Based on these findings, the following information on the status of the NPO SMA is provided by the ISC25 Plenary:

1. **No biomass-based or fishing mortality-based limit or target reference points have been established for NPO SMA by the IATTC or WCPFC;**

2. **Recent median depletion ($D_{2019-2022}$) is estimated from the model ensemble to be 0.60 (95% CI = 0.23-1.00). The recent median $D_{2019-2022}$was 1.17 times D_{MSY} (95% CI = 0.46-1.92) and the stock is likely (66% probability) not in an overfished condition relative to MSY-based reference points;**

3. **Recent harvest rate ($U_{2018-2021}$) is estimated from the model ensemble to be 0.018 (95% CI = 0.004-0.07). $U_{2018-2021}$ was 0.34 times (95% CI = 0.07-1.20) U_{MSY} and overfishing of the stock is likely not occurring (95% probability) relative to MSY-based reference points;**

4. **The model ensemble results showed that there is a 65% joint probability that the North Pacific SMA stock is not in an overfished condition and that overfishing is not occurring relative to MSY based reference points; and**

5. **Several uncertainties may limit the interpretation of the assessment results including uncertainty in catch (historical and modeled period) and the biology and reproductive dynamics of the stock, and the lack of CPUE indices that fully index the stock.**

Conservation Information

Stock projections of depletion and catch of North Pacific SMA from 2023 to 2032 were performed assuming four different harvest policies: $U_{2018-2021}$, U_{MSY}, $U_{2018-2021} + 20\%$, and $U_{2018-2021} - 20\%$ and evaluated relative to MSY-based reference points. Based on these findings, the following conservation information is provided:

1. **Future projections in three of the four harvest scenarios ($U_{2018-2021}$, $U_{2018-2021} + 20\%$, and $U_{2018-2021} - 20\%$) showed that median depletion in the North Pacific Ocean will likely (>50% probability) increase; only the U_{MSY} harvest scenario led to a decrease in median depletion.**

2. **Median estimated depletion of SMA in the North Pacific Ocean will likely (>50% probability) remain above D_{MSY} in the next 10 years for all scenarios except U_{MSY}; harvesting at U_{MSY} decreases D towards D_{MSY}.**

3. **Model projections using a surplus production model may oversimplify the age structured population dynamics and as a result could be overly optimistic.**

8.5 North Pacific Swordfish

M. Sculley, BILLWG Chair noted that the last stock assessment was conducted in 2023, and the next assessment is planned for 2028 and they recommended the stock status and conservation information for NPO SWO presented at ISC23. The ISC25 Plenary reviewed and agreed to forward the stock status and conservation information adopted at ISC23, which was based on the 2023 stock assessment (see Section 6.5.2, pp. 35-42 in the ISC23 Plenary Report).

8.5.1 Stock Status and Conservation Information

Stock Status

Estimates of population biomass fluctuated around an average of 80,800 t during 1975-2021 and was estimated to be 88,800 t in 2021. Initial estimates of female spawning stock biomass (SSB) averaged around 27,600 t in the late 1970s. SSB was at its highest level of 35,778 t in 2021 and was at its minimum of 22,415 t in 1981. Overall, spawning stock biomass has been relatively stable for the entirety of the assessment period. Estimated F (arithmetic average of F for ages 1 – 10) decreased from 0.17 year^{-1} in 1978 to a minimum of 0.09 year^{-1} in 2021. It averaged roughly F=0.09 yr^{-1} during 2019-2021 or about 51% of F_{MSY} with a relative fishing mortality of F/F_{MSY} = 0.49 in 2021. Fishing mortality has been below F_{MSY} since the beginning of the assessment time period and has had a declining trend with the exception of a high peak in 1998 coinciding with high catch by the U.S. longline fleet. Recruitment (age-0 fish) estimates averaged approximately 838,000 individuals during 1975-2021. While the overall pattern of recruitment varied, there was no apparent trend in recruitment strength over time. Overall, total annual catch is declining, CPUE is increasing, and recruitment is relatively stable.

WCPFC16 established a limit reference point for the exploitation rate of NPO SWO of F_{MSY}. $SSB_{F=0}$ was set to equal the average of the last 5 years dynamic B_0 assuming no fishing during those years. NPO SWO reference points will be provided with reference to MSY and with reference to 20%$SSB_{F=0}$.

Based on these findings, the following information on the status of the NPO SWO stock is provided by the ISC25 Plenary:

1. **When the status of NPO SWO is evaluated relative to MSY-based reference points, the 2021 SSB of 35,778 mt is 220% of SSB_{MSY} (16,000 mt) and the 2019-2021 average F is about 49% below F_{MSY}; and**

2. **Relative to MSY-based reference points, overfishing is very likely not occurring (>99% probability) and the NPO SWO stock is very likely not overfished (>99% probability).**

<u>**Conservation Information**</u>

Projections started in 2022 and continued through 2031 under five levels of fishing mortality. The 5 fishing mortality stock projection scenarios were: (1) F at 20%$SSB_{(F=0)}$ which was calculated from the mean dynamic SSB in the 5 years, (2) $F_{(2008-2010)}$ which are the reference years for the proposed CMM for NPO SWO, (3) F_{Low} at $F_{30\%SPR}$, (4) F_{MSY}, and (5) F status quo (average F during 2019-2021). Results show the projected female spawning stock biomass and the catch biomass under each of the scenarios.

Based on these future projections, the following conservation information for NPO SWO is provided by the ISC25 Plenary:

1. **The NPO SWO stock has produced annual yields of around 11,500 mt per year since 2016, or about 2/3 of the MSY catch amount;**

2. **NPO SWO stock status is positive with no evidence of F above F_{MSY} or substantial depletion of spawning potential; and**

3. **It was also noted that retrospective analyses show that the assessment model appears to underestimate spawning potential in recent years.**

8.6 Pacific Blue Marlin Stock Status and Conservation Information

Since the Pacific BUM stock was last assessed in 2021, M. Sculley, BILLWG Chair noted that the last stock assessment was conducted in 2021, and the next assessment is planned for 2026 and they recommended the stock status and conservation information for PO BUM presented at ISC21 (see Section 3.3.3, pp. 25 ISC21 Plenary Report).

8.6.1 Stock Status and Conservation Information

Stock Status

Stock status, biomass trends, and recruitment of Pacific BUM for both models in the ensemble had similar trends, although the estimates of initial conditions are different. All reported results are the model-averaged estimates from the ensemble model unless otherwise noted. Estimates of population biomass declined until the mid-2000s, increased again until 2021, and has been relatively flat until the present. The minimum spawning stock biomass is estimated to be 17,592 t in 2006 (5% above SSB_{MSY}, the spawning stock biomass to produce MSY, 95% C.I. 14,512-20,703 t, SSB/SS_{MSY} 95% C.I. 0.70-1.01). In 2019, SSB = 24,272 t and the relative SSB/SSB_{MSY} = 1.17 (95% C.I. 0.87-1.51). Combined median fishing mortality on the stock (average F on ages 1-10) is currently below F_{MSY}. It averaged roughly F = 0.13 yr^{-1} during 2017-2019, or 40% below F_{MSY}, and in 2019, F=0.11 yr^{-1} with a relative fishing mortality of F/F_{MSY} = 0.50 (95% C.I. 0.37-0.69). Median fishing mortality has been below F_{MSY} every year except 2003 to 2006. The predicted value of the spawning potential ratio (SPR, the predicted spawning output at current F as a fraction of unfished spawning output) is currently $SPR_{2017\text{-}2019}$ = 31% for the combined model, which is above the SPR required to produce MSY (17%). Recruitment was relatively consistent throughout the assessment time period, with occasional pulses in recruitment, but no notable periods of below-average recruitment. No target or limit reference points have been established for Pacific BUM under the auspices of the WCPFC. Pacific BUM is expected to be highly productive due to its rapid growth and high resilience to reductions in spawning potential. Although fishing mortality has approached MSY and exceeded MSY from 2003 to 2006, the biomass of the stock has remained above MSY. With continued decreases in Pacific BUM catch and fishing effort, the stock is expected to remain within MSY limits. When the status of BUM is evaluated relative to MSY-based reference points, the 2019 spawning stock biomass of 24,272 t is 17% above SSB_{MSY} (20,677 t, 95% C.I. -13% to +50%) and the 2017-2019 fishing mortality is 50% below F_{MSY} (95% C.I. 37% to 69%).

Based on these findings, the following information on the status of the Pacific BUM stock is provided by the ISC25 Plenary:

1. **No target or limit reference points have been established for BUM by the IATTC and the WCPFC;**

2. **Female spawning stock biomass was estimated to be 24,241 t in 2019, or about 17% above SSB_{MSY} and 17% above 20%SSB_0;**

3. **Fishing mortality on the stock (average F, ages 1 to 10) averaged roughly F = 0.13 during 2016-2019, or about 40% below F_{MSY} and 28% below $F_{20\%SSB0}$; and**

4. **Blue marlin stock status based on the ensemble model shows that relative to MSY-based reference points, overfishing was very likely not occurring (>90% probability) and Pacific BUM is likely not overfished (81% probability).**

Conservation Information

The Pacific BUM stock has produced annual yields of around 18,800 mt per year since 2015, or about 90% of the MSY catch. Pacific BUM stock status from the ensemble model shows that the current median spawning biomass is above SSB_{MSY} and that the current median fishing mortality is below F_{MSY}. However, uncertainty in the stock status indicates a 19% chance of Pacific BUM being overfished relative to SSB_{MSY}. Both the old and new growth models show evidence of spawning biomass being above SSB_{MSY} and fishing mortality being below F_{MSY} during the last 5 years. Catch biomass has been declining for the last 5 years, and therefore the stock has a low risk of experiencing overfishing or being overfished unless fishing mortality increases to above F_{MSY} based upon stock projections. However, it is also important to note that retrospective analyses show that the assessment model tends to overestimate biomass and underestimate fishing mortality in recent years, in part due to rapid changes in longline CPUE.

Based on these findings, the following conservation information is provided for the Pacific BUM stock by the ISC25 Plenary:

1. **There is no evidence of excess fishing mortality above F_{MSY} ($F_{2016\text{-}2019}$ is 40% of F_{MSY}) or substantial depletion of spawning potential (SSB_{2019} is 17% above SSB_{MSY});**

2. **It is important to note that retrospective analyses show that the assessment model appears to overestimate spawning stock biomass in recent years; and**

3. **The results show that projected female spawning biomass is expected to increase under the $F_{status\ quo}$ and $F_{30\%}$ harvest scenarios and decline to SSB_{MSY} under the High F and F_{MSY} harvest scenarios. The probability that the stock is overfished or overfishing occurring by 2029 under each harvest scenario is low.**

8.7 WCNPO Striped Marlin

M. Sculley, BILLWG Chair noted that the last stock assessment was conducted in 2023 and the next assessment is planned for 2027 and they recommended the stock status and conservation information for WCNPO MLS presented at ISC23 which was based on the 2023 stock assessment (see Section 6.7.2, pp. 46-49 in the ISC23 Plenary Report). In addition, the WG updated projection runs for the WCNPO MLS rebuilding analysis to reflect the catch distribution by country from the CMM 2024-06. The conservation information reflected the updated information.

8.7.1 Stock Status and Conservation Information

Stock Status

Estimates of population biomass from the base case fluctuated around an average of 11,300 t during 1977 2020 and was estimated to be 7,300 t in 2020. Initial estimates of female SSB averaged around 4,700 t during the 1977-1979 period. SSB was at its highest level of 5,096 m t in 1977, and declined to lowest level, 1,080 t, in 2011. The time series of SSB during 2011-2020 averaged about 1,200 metric tons (Table 4), or about 33% of the dynamic 20 year $20\%SSB_{F=0}$ and about 42% of SSB_{MSY} (Table 5). Overall, SSB exhibited a strong decline during 1992-1998 and has stabilized to an average of about 1,400 t through the 2000s. Estimated fishing mortality (arithmetic average of F for ages 3-12) increased from 0.53 yr^{-1} in 1977 to a peak of 1.42 yr^{-1} in 1998, and subsequently declined to 0.58 yr^{-1} in 2020. It averaged roughly F=0.68 yr^{-1} during 2018-2020 or about 28% above $F_{20\%SSBF=0}$ and 8% above F_{MSY}, with a relative fishing mortality of $F/F_{20\%SSBF=0}$ = 1.09 in 2020. Fishing mortality has been above $F_{20\%SSBF=0}$ and F_{MSY} since the beginning of the assessment time period but has had a declining trend since 1998. Recruitment (numbers of age 0 fish) estimates averaged approximately 366,000 during the 1977-2020 period. While the overall pattern of recruitment from 1977 to 2020 varied, there was an apparent declining trend in recruitment strength over time with higher recruitments observed during the 1977-1992 period and lower recruitments from 2000 to the present.

Recruitment from 2001 to 2020 averaged about 225,000 age 0 fish, which was 60% of the 1977 2020 average. The WCPFC has requested that the BILLWG to provide estimates of stock status for WCNPO MLS relative to biological reference points based on 20% of a dynamic SSB_0 estimate ($SSB_{(F=0)}$), where SSB_0 is the moving average of the last 20 years SSB_0 estimates. Despite the relatively large L_{50}/L_{inf} ratio for WCNPO MLS, the stock is expected to be highly productive due to its rapid growth and high resilience to reductions in spawning potential. Recent recruitments have been lower than expected and have been below the long term average since 2000. Although fishing mortality has decreased since 2000, two decades of low recruitment combined with consistent landings of immature fish have inhibited increases in spawning biomass since 2001.

Based on these findings, the following information on the status of the WCNPO MLS stock is provided by the ISC25 Plenary:

1. **When the status of WCNPO MLS is evaluated relative to dynamic $20\%_{SSBF=0}$ based reference points, the 2020 spawning stock biomass of 1,696 t is 54% below $20\%SSB_{F=0}$ (3,660 t) and the 2018-2020 fishing mortality is about 28% above $F_{20\%SSB(F=0)}$; and**

2. **Therefore, relative to $20\%SSB_{F=0}$ based reference points, the WCNPO MLS stock is very likely to be overfished (>99% probability) and is likely to be subject to overfishing (>66% probability).**

<u>Conservation Information</u>

Stock projections for WCNPO MLS were conducted using two deterministic scenarios for future recruitment: the expected stock recruitment relationship and the average recruitment in the last 20 years (2001-2020). Projections started in 2021 and continued through 2040. Five levels of fishing mortality with the two recruitment scenarios and the ten catch levels with only the 20-year average recruitment scenario were applied for projections. The five fishing mortality scenarios were: F status quo (average F during 2018 2020), F_{MSY}, F at $20\%_{SSBF=0}$, F_{High} at the highest 3-year average during 1977-2017 (1998-2000), and F_{Low} at $F_{30\%}$. The ten catch level scenarios were: No catch (F=0), 500 t catch, 1,000 t catch, 1,500 t catch, 2,000 t catch, 2,300 t catch, 2,400 t catch, 2,500 t catch, 3,000 t catch, and 3,500 t catch.

Twenty results show the projected female spawning stock and catch biomasses under each scenario. When recruitment is assumed to be consistent with the stock recruitment relationship, then only two fixed F scenarios result in the WCNPO MLS stock rebuilding beyond SSB_{MSY} and $20\%SSB_{F=0}$: F_{Low} and $F_{20\%SSB(F=0)}$. In contrast, when recruitment is assumed to be the average over the last 20 years (2001-2020), none of the fixed F scenarios result in the stock rebuilding to or beyond $F_{20\%SSBF=0}$ and only one scenario, F_{Low}, resulted in the stock rebuilding above the SSB_{MSY} level (Figure 20b). Constant catch scenario results are different than the constant F projection results. At catch levels less than 2,400 t, the projections show that the WCNPO MLS stock rebuilds beyond the SSB_{MSY} and $20\%SSB_{F=0}$ levels by 2040.

The assumed recruitment levels for projections vary substantially for the two scenarios, with the average recruitment from the stock recruitment curve around 350,000 individuals per year and the recruitment from the low recruitment scenario around 225,000 individuals per year. In the past, the WG has recommended that management measures consider the low recruitment scenarios as the projections using the stock recruitment curve do not consider the long-term declining trend in recruitment (ISC21). If spawning biomass rebuilds to the target, which is about equal to the average spawning biomass observed during the 1977-1989 period, then recruitment may be expected to return to the high levels observed during the 1977-1989 period or about 2 fold higher than current recruitment. The WG intends to provide additional stochastic ensemble projection results considering model uncertainty, as requested by WCPFC16. One of the important axes of uncertainty will be the assumptions on future recruitment.

Based on these findings, the following information on the conservation of the WCNPO MLS stock is provided by the ISC25 Plenary:

1. **It is recommended that catch should be kept at or below the recent level (2018-2020 average catch = 2,428 t); and**

2. **The results of deterministic projections show that when catches are 2,400 t, or less, the stock is expected to recover above SSB_{MSY} and near the 20% $SSB_{F=0}$ reference level by 2040, or sooner at the lower catch levels under a low recruitment regime (3,660 t). Recent catches have been lower than 2,400 t and new projections suggest the possibility for a more rapid recovery. However, the 2,400 t limit and additional reductions are still recommended to meet the WCPFC rebuilding plan target, based on the updated rebuilding analysis provided in this report.**

Special Comments

While the WG agreed upon a base case model for WCNPO MLS, there is concern about the reliability of the base case results for providing conservation advice due to uncertainty in growth, Japanese driftnet catches and initial conditions of the model. The ISC22 Plenary requested that the WG continue working on the 2022 WCNPO MLS base case model, with a focus on the growth parameters, particularly incorporating the Richard's four parameter growth curve directly into the SS3 model, for presentation to ISC23. The WG concluded that a revised von Bertalanffy growth curve rather than the Richard's curve was the best information available at this time for use in the 2023 base case model, while highlighting the suite of sensitivity runs to show the sensitivity of the model to changes in the growth curve; see the list and description of the sensitivity runs in Table 12 in **ISC/23/ANNEX/14**). The sensitivity runs show that the growth curve assumption may affect the interpretation of stock status. The WG also noted a concern that the estimation of initial F and thus the virgin biomass scale is largely affected by the selection of the growth curve, as the initial catch remains uncertain.

The WG recognized that substantial uncertainties have been discussed and documented in this stock assessment report (**ISC/23/ANNEX/14**). The high seas drift net catch data are highly uncertain owing to availability of limited records, life history parameters, such as growth, have been estimated from limited data, and stock is subject to mixing with other management areas, as revealed by genetic analyses. The WG evaluated the fit of several growth assumptions to the data and other diagnostics. The WG found that the stock assessment results showed large differences in estimated biomass among various growth curves. Future improvements of the growth curve are expected due to incoming data from the ongoing International Billfish Biological Sampling program, which will be followed by continued biological research and model development to address other sources of uncertainty.

9 ISC OPEN SCIENCE PROGRESS REPORT

M. Sculley, USA, reported on year one activities for the ISC Open Science Proposal that was adopted at ISC Plenary 24. Two Open Science workshops were offered: one in conjunction with the ISC BILLWG meeting in Honolulu, HI January 13-16, 2025, and one in conjunction with the ISC SHARKWG meeting in Yokohama, Japan, January 27-29, 2025. A total of 22 participants from 6 ISC members and cooperating non-members. The topics covered in each training session included: version control with git and github, reproducible environments with renv and codespaces, script-based model development with stock synthesis, code review in github, automated reports with quarto, creating shiny apps, and hosting websites associated with code repositories on github.

Discussion

The Plenary expressed appreciation for the efforts to enhance efficiency and transparency among ISC Working Groups, including through the open science initiatives to improve collaboration and public accessibility. There was a suggestion to follow up with training participants to assess whether the new tools are being integrated into regular workflows, noting that in some cases this would represent a significant shift from standard practices.

The ISC Chair agreed to work with the ISC Website Administrator to link to open science materials from working groups on the ISC website.

10 INCORPORATING CLIMATE CHANGE CONSIDERATIONS

The ISC Chair asked for discussion related to the Climate Change Matrix that was tasked to the working groups in 2024. The matrix is not intended to be an exhaustive exercise but a starting point to stimulate conversation about new ways to analyze data or integrate data that may be impacted by climate change. Within the working groups it is intended to highlight where non-stationarity may arise and how to best address the impacts when providing management advice and conservation status. It was also intended to highlight where data needs to be improved to counteract the shrinking window of time where data is informative.

<u>Discussion</u>

The Working Groups expressed shared challenges and considerations in integrating climate change into stock assessments. Discussions emphasized the complexity, uncertainty, and data limitations associated with incorporating environmental variables into stock assessments. The Working Groups found the climate matrix aspirational and difficult to populate due to limited relevant data. However, it stimulated valuable discussions on how to incorporate climate and environmental variables into future assessments. Members acknowledged the need to improve spatial and temporal aspects of CPUE standardization, and emphasized the need to the current challenges associated with the incorporation of oceanographic data, including data availability, resolution mismatches, and linking environmental indices (e.g., PDO) to fish distribution and productivity. Members also emphasized the difficulty in integrating uncertain and qualitative climate projections into quantitative models. Traditional assessments focus on current conditions, while climate impacts are future-oriented and more uncertain. It was agreed that future consideration should be given to conceptual models, periodic benchmark reviews, and diagnostics (e.g., length-frequency shifts, residual patterns) to capture possible climate influences. Members agreed that it would be useful to develop a standardized environmental data repository, which includes best practices and guidance for incorporating climate indices into assessments. The idea of an ISC climate workshop was also discussed, potentially to be held in conjunction with a future ISC plenary, where experts could be invited in order to build understanding and capacity across Working Groups. **The ISC Chair agreed to reach out to Working Groups to collect input on best practices and current data gaps, and to explore greater coordination with external bodies, including PICES.**

11 WCPFC REPORTING OF STOCK STATUS AND MANAGEMENT ADVICE

The ISC Chair opened discussion related to the management advice templates provided in the WCPFC PROJECT 113B (**ISC/25/ANNEX/11**). The ISC, during ISC23 recommended that the ISC develop recommendations for the presentation of uncertainty and associated management advice consistent with those adopted by the WCPFC SC. The WCPFC PROJECT 113B provides templates for the presentation of management advice. The chair requested input on if the ISC agrees to utilize this framework for presenting management advice and if there are challenges for particular assessment to match the suggested templates.

<u>Discussion</u>

Members discussed the value of consistent reporting in order to enhance clarity, consistency, and usability of scientific advice for managers while allowing some flexibility based on data and assessment specifics. **ISC25 agreed that Working Groups should review the WCPFC Stock Status and Management Advice template and endeavor to use it as a guideline in future stock assessment reports**

12 ISC - WCPFC MOU

The ISC Chair opened discussion to seek clarification regarding the presentation of ISC scientific information and advice to the Northern Committee and the Scientific Committee, as well as the Commission (**ISC/25/ANNEX/12**). The chair was seeking input on the perception that there is no opportunity for the SC to provide input on ISC assessments.

Discussion

Members discussed whether potential modifications to the current ISC-WCPFC MOU might be necessary, in order to allow for specific requests from the WCPFC Scientific Committee and Commission, in addition to the Northern Committee. Members highlighted a recent increase in collaboration between ISC Working Groups, SPC and WCPFC. There was general agreement that the current MOU is working well and likely no modifications are needed at this time.

13 ISC – PICES RELATIONSHIP

The ISC chair raised the scientific collaboration agreement between the ISC and PICES developed in 2015 (**ISC/25/ANNEX/13**). The Chair asked the ISC if there was interest in further developing work that could enhance ISC scientific understanding, with PICES.

Discussion

Members reiterated the existing relationship between ISC and PICES, and encouraged continued communication with PICES, particularly on issues related to the impacts of changing climate. PICES participants were also in attendance and confirmed interest in collaborating on climate issues and other related fisheries topics. The ISC Chair will report out to the next PICES meeting on emerging issues and needs.

14 ISC REVIEW

Peer reviews of ISC functions are expected to occur every 5 years and the last one occurred in 2018-19. The ISC Chair opened discussions aimed at identifying the focus and process for the next peer review.

Discussion

The ISC Chair requested feedback from members on the development of a ToR for the next 5-year ISC review. The United States suggested three key review themes: 1) evaluate ISC's progress in responding to recommendations from the previous five-year review; 2) assess the overall transparency of ISC, including how ISC aligns with transparency norms in other RFMOs, and taking into consideration its unique structure and reliance on in-kind member support; and 3) explore efficiency improvements in ISC practices, including consideration of resource constraints, evolving ocean conditions, and opportunities for innovation (e.g., CKMR, shifting distributions, model development). Members were generally supportive of these key themes, and suggested consideration of meeting logistics and scheduling to be included in review of efficiency improvements, and consideration of communication & collaboration with RFMOs and other organizations to be included in review of the overall transparency of ISC. It was also emphasized that the TORs will need to be clear and focused in order to ensure that the review is successful. Funding for the review will need to be further explored, including whether ISC members might be able to support the review or whether outside resources will be required. **ISC25 agreed that the next 5-year ISC Review will focus on a review of progress since the last five-year review, current ISC practices surrounding operation, transparency, and collaboration, and identifying ways to improve operational and scientific efficiency in the ISC. The ISC Chair agreed to begin the development of TORs for the review to circulate to ISC members for further consideration. Once funding is secured, the ISC Chair will solicit nominations for reviewers through a process similar to the process for the external review of ISC stock assessments.**

15 FORMALIZATION OF ISC

The ISC Chair revisited the challenges with formalization of the ISC. With no secretariat or funding mechanism, the ability of the ISC to maintain its function depends on in-kind contributions from its members. Should the need for the ISC to conduct regular assessment reviews as well as develop MSE continue a mechanism for members to contribute to the cost of these activities needs to be developed.

Discussion

Members generally agreed that the formalization of ISC is not realistic at this time, but emphasized the need to continue discussions on a potential funding pathway to maintain an ISC peer review process to improve scientific outputs, and to assist with additional scientific analyses including future MSE. It was noted that the current ISC-WCPFC MOU specifies that the WCPFC can pay costs for special scientific advice requested by the Commission. **ISC25 agreed to submit a request to the Northern Committee to understand if there is a desire for more regular reviews of ISC assessments and if a more formal peer review mechanism and related funding structure needs to be developed.**

16 REVIEW OF STATISTICS AND DATABASE ISSUES

16.1 STATWG Report

K. Nishikawa, STATWG Vice Chair, reviewed activities in the 2024-2025 workplan adopted at the ISC24 (**ISC/25/ANNEX/14**). Almost all work items were completed in the past year. The STATWG agreed there is an ongoing need for the STATWG to provide the functions of (1) maintaining the ISC database and the quality of data submitted by members; (2) maintaining the proper function of ISC website and the archiving of the stock assessment files; and (3) supporting internal data sharing and protocols for external data requests. The STATWG members developed the following work plan for 2025-2026:

1. The DA will continue to distribute the ISC data inventory for Category I, II, and III to ISC Data Correspondents for review by September 30, 2025. The DA will then distribute the ISC data inventory to Chairs of the species WG by October 15, and publish it on the ISC website by October 31, 2025.

2. After the Data Correspondents have reviewed and updated their metadata prior to the ISC25 Plenary, this metadata will be published on the ISC researcher's website by August 31, 2025. For 2024-2025, the DA will continue to distribute the WG member's new metadata by March 30, 2026. The Data Correspondents will review and update their new metadata by June 1, 2026 prior to the ISC26 Plenary, and this new metadata will be published on the ISC researcher's website by August 31, 2026.

3. The DA will archive PBF and ALB MSE input files.

4. The DA and the Chair of the STATWG will annually review the responsibilities, duties and deliverables of the DA to ensure that they are accurate and practical, and revise them as necessary.

5. The STATWG Steering Group will hold an intersessional meeting or conference call/webinar January 2026, if needed.

16.2 Total catch tables

K. Nishikawa, the STATWG Vice Chair and Database Administrator, presented the annual catch tables for ISC members for 2023-2024. The catch tables were prepared for the following ISC species of interest: NPO ALB, PBF, NPO SWO, WCNPO MLS, Pacific BUM, NPO BSH, and NPO SMA. The catch tables were generated from the ISC database and are based on Category I data (retained catch and released catch, when available) submitted by Data Correspondents for the major fisheries in the North Pacific Ocean of the members. Graphs of the historical catch by country were also presented for each species. Statistics for mean, minimum, and maximum catch were also presented for each species for the latest 5 years. The complete catch tables are included at the end of this Plenary Report and serve as the official ISC catch tables (see Section 22).

17 REVIEW OF MEETING SCHEDULE

17.1 Time and Place of ISC26

Chinese Taipei offered to host ISC26 at a location to be determined, tentatively scheduled for June 22-29, 2026.

17.2 Time and Place of Working Group Intercessional Meetings

The Plenary reviewed and adopted the schedule of intersessional meetings found on the following pages.

	Month	ALBWG	BILLWG	PBFWG	SHARKWG	STATWG	PLENARY	WCPFC	IATTC
2025	July							JWG PBF July 09-12, 2025 Toyama City, Japan	
								NC21 14-15, Toyama City, Japan	
	Aug							SC21 13-21 2025 Tonga	
	Sept								103rd 1-5 TBD
	Oct	Oct 27 - Nov 2, 2025 Yokohama, Japan							
	Nov		Nov 11-17, 2025 Yokohama, Japan						
	Dec							WCPFC21 1-5 Manila, Philippines	
2026	Jan				Date TBD Virtual				
	Feb				Date TBD Virtual	Date TBD Virtual			
	Mar	23-30, 2026 La Jolla, USA		20-27, 2026 Sapporo, Japan	Date TBD La Jolla, USA				
	April		Date TBD						
	May								17th SAC Meeting Date TBD
	June	Prior to ISC26	Prior to ISC26	Prior to ISC26	Prior to ISC26	Prior to ISC26	June 22-29 Chinese - Taipei		

17.3 Schedule of Stock Assessments

Species	Region	2025	2026	2027	2028	2029	2030	2031
Albacore Tuna (*Thunnus alalunga*) ALB	NPO		B			B		
Swordfish (*Xiphias gladius*) SWO	NPO				B			
Striped marlin (*Kajikia audax*) MLS	WCNPO			B				
Blue marlin (*Makaira nigricans*) MLS	PO		B					B
Pacific bluefin tuna (*Thunnus orientalis*) PBF	NPO			U/B			U/B	
Blue shark (*Prionace glauca*) BSH	NPO	I		B				
Shortfin mako shark (*Isurus oxyrinchus*) SMA	NPO					B		

B – benchmark, U – update, I – indicator

18 ADMINISTRATIVE MATTERS

18.1 Work Group Election results

The Plenary confirmed the following officers and terms:

Title	Name	First term election date	First term	Second term election date	Second term	First Extension (Chair)	Second Extension (Chair)
ISC Chair	Robert Ahrens	Jun-24	2024-2027				
ISC Vice Chair	Shuya Nakatsuka	Jun-24	2024-2027				
ALBWG Chair	Sarah Hawkshaw	May-21	2021-2024	Apr-24	2024-2027		
ALBWG Vice-Chair	Yuichi Tsuda	Jul-24	2024-2027				
BILLWG Chair	Michelle Sculley	Jul-23	2023-2026				
BILLWG Vice-Chair	Yi-Jay Chang	Jul-19	2019-2022	Jul-22	2022-2025	Jun-25	2025-2028
PBFWG Chair	Shuya Nakatsuka	Mar-19	2019-2022	Jul-22	2022-2025	Jul-25	
PBFWG Vice-Chair	Shui Kai Chang	Nov-19	2020-2023	Jul-23	2023-2026		
SHARKWG Chair	Michael Kinney	Jun-24	2024-2027				
SHARKWG Vice-Chair	Yasuko Semba	Jun-24	2024-2027				
STATWG Chair	Jenny Suter	Jul-23	2023-2026				
STATWG Vice-Chair	Kirara Nishikawa	Jul-23	2023-2026				

18.1 ISC Organization Chart

The Plenary reviewed the organizational chart shown below and updated personnel to reflect current participation.

Webmaster	Database
T. Irie	K. Nishikawa

Plenary	
7 Robert Ahrens (C)	6 L. Carrillo
5 Shuya Nakatsuka (VC)	7 F. Carvalho
1 S. Hawkshaw	7 K. Koch
2 Z. Geng	8 S. Batten
3 T.-K. Wen	9 G. Pilling
4 H. Kim	11 C. Montero
5 H. Kiyofuji	12 S.K. Soh

ALBWG	BILLWG	PBFWG	SHARKWG	STATWG
1 S. Hawkshaw (C)	7 M. Sculley (C)	5 S. Nakatsuka (C)	7 M. Kinney (C)	7 J. Suter (C)
2 Z. Geng	2 Z. Geng	2 Z. Geng	1 S. Anderson	1 S. Hawkshaw (ALB C)
3 Y.-J. Chang	3 Y.-J. Chang (VC)	3 S.-K. Chang (VC)	2 Z. Geng	2 Z. Geng
4 H. Park	3 C.-L. Sun	4 H. Park	3 W.-P. Tsai	3 W. J. Wang
5 Y. Tsuda (VC)	4 H. Park	5 H. Fukuda (DM)	4 H. Park	4 H. Park
6 M. Dreyfus	5 M. Jusup	6 M. Dreyfus	5 Y. Semba (VC, DM)	5 T. Ire (WM)
7 S. Teo	5 M. Kai	6 M. Betancourt	5 M. Kai	5 K. Nishikawa (VC)
7 P. Kuriyama	6 J. Diaz	7 D. Tommasi	6 J.J. Fernandez - Mendez	5 S. Nakatsuka
9 P. Hamer	6 J. Tovar	7 H.-H. Lee	7 N. Ducharme-Barth	5 H. Fukuda (PBF DM)
10 H. Xu	7 J. Brodziak	9 G. Pilling	7 F. Carvalho	5 K. Satoh
12 S.K. Soh	9 G. Pilling	10 M. Maunder	7 M. Oshima	5 Y. Semba (SHRK DM)
	10 C. Minte-Vera	12 S.K. Soh	9 G. Pilling	6 M. Dreyfus
	12 S.K. Soh		9 P. Hamer	6 M. Bentacourt
			10 M. Hutchinson	7 M. Kinney (SHK C)
			10 D. Ovando	7 M. Sculley (BILL C)
			12 S.K. Soh	7 Y. Gu
				9 G. Pilling
				12 S.K. Soh

1 - Canada 2 - China 3 - Chinese-Taipe 4 - Korea 5 - Japan 6 - Mexico 7 - USA 8 - PICES 9 - SPC 10 - IATTC 11 - FAO 12 – WCPFC
C - Chair VC - Vice Chair DM - Database manager

This is not a comprehensive list but the main points of contact

18.2 North Pacific Marine Science Organization (PICES) Annual Meeting Observer

The ISC Chair provisionally agreed to serve as an ISC observer remotely at the PICES AGM at the next PICES Annual Meeting, November 8 to November 14, 2025 Yokohama, Japan.

18.3 Intersessional Working Group Tasks

ISC CHAIR and OFFICE of the CHAIR

- Will represent ISC at PICES AGM
- Canvas members about the ToRs of a third peer review of the ISC function and process
- Consult with members regarding a pathway to ensure funding for assessment reviews should the Northern Committee of the WCPFC decide to require a more regular review schedule.
- Climate change – continue to advance work on incorporating climate considerations into ISC advice and explore options to improve ISC data access to historic and future oceanographic information.
- Work with the Webmaster to update ISC website with "Open Science" dropdown menu and WG Chair names and email addresses to contact for access to repositories on GitHub.
- Notify other organizations that they need to document requests to ISC separately in a letter to the ISC Chair
- Chair the PBF assessment review should the need arise.
- Coordinate the presentation of PBF review outcomes at ISC 26

ISC MEMBERS

- Members to internally explore approaches to supporting ISC such as peer reviews.
- Members to continue working on climate change with the goal of developing a collective and collaborative plan for ISC Science
- Provide summaries of all North Pacific Ocean HMS fisheries (annual catch by species and gear, number of vessels by gear and size category and average size of fish caught by species and fishery for entire NPO) in National Reports and to ISC database;
- Submit ISC26 documents by dates set out below:
- WG working papers are due to Office of the ISC Chair (OOC) and Webmaster immediately after completion of the WG workshop for posting on the ISC website;
- April 30 - Final Stock Assessment Reports due to OOC;
- May 30 – Final Stock Assessment Reports due to OOC for assessments completed in April
- June 1 – deadline for OOC to receive National Reports
- June 10 - distribution of all documents for Plenary meeting electronically.
- June 1st - Deadline for members to report Category I, II and III data to the ISC Final stock assessment reports.
- Taiwan – prepare to host ISC26, WG meetings June 22-23th Plenary June 24-29, 2026.

ALBWG

- Respond to NC21 requests should there be any.

- Members are to prepare data and analyses through 2024 for the November Data Preparation Meeting in Yokohama Japan.
- Members are to evaluate exceptional circumstances criteria and determine their inclusion in the 2026 assessment for the November Data Preparation Meeting in Yokohama Japan.
- Conduct the assessment of NPO-ALB though 2024 during the March Stock Assessment Workshop.
- Conduct workshop in advance of ISC26
- Present assessment results to ISC26 Plenary.

PBFWG

- Present PBF MSE results to IATTC-NC21 JWG
- Respond to NC21 requests should there be any.
- Present PBF MSE results WCPFC SC, August 2025.
- Present PBF MSE results IATTC, September 2025.
- Present PBF MSE results WCPFC, November 2025.
- Prepare for External Peer Review of Stock PBF Assessment March 2026

BILLWG

- Respond to NC21 requests should there be any.
- Continue to refine the assessment approach for WCNPO MLS
- Continue to progress International Billfish Biological Sampling (IBBS) Program.
- Progress the integration of climate effects in to NPO SWO projections.
- Members are to prepare data and analyses through 2024 for PO-BUM for the November Data Preparation Meeting in Yokohama Japan.
- Conduct the benchmark assessment of PO-BUM though 2024 during the April (?) Stock Assessment Workshop.
- Conduct workshop in advance of ISC26.
- Report on IBBS Program at ISC26.
- Present PO-BUM benchmark assessment results to ISC26 Plenary.

SHARKWG

- Blue Shark Conceptual Model Workshop 2-day online meeting to build the foundation for the 2027 benchmark stock assessment January/February 2026
- Blue Shark Data Improvement meeting data improvement and CKMR reporting February/March 2026.
- Conduct meeting in advance of ISC26.

STATWG

- Update website software.
- E-mail sending system revisions.
- Update website packages to resolve file size issues.

- Change WAF service to reduce operational costs.
- Facilitate archiving of MSE file for reproduceable science.
- The DA to distribute the ISC data inventory to ISC Data Correspondents for review by September 30, 2025 and to Species WG Chairs by October 15, 2025
- The DA to publish the ISC data inventory on the ISC website by October 31, 2025;
- Metadata for national fisheries updated and published by DA on ISC researcher's website by August 31, 2025.
- Conduct a meeting prior to ISC26.

19 OBSERVER COMMENTS AND RECOMMENDATIONS

Observers from the Monterey Bay Aquarium, World Wide Fund for Nature-Japan (WWF Japan), The Ocean Foundation, and Accountability.Fish participated in the ISC25 Plenary Session and were provided with an opportunity at the end of each day to ask questions and provide comments and recommendations to the Plenary and Working Groups. Their comments and detailed statements are included as Appendix 1.

Accountability.Fish suggested the that the ISC is significantly less transparent than other fisheries governance instruments and RFMOs, particularly in its approach to civil society engagement in the scientific process. Unlike bodies such as ICCAT, IOTC, IATTC, SPRFMO, and WCPFC, which allow observer participation, document sharing, and input during scientific discussions, the ISC systematically restricts such access—especially in its working groups where foundational scientific advice is developed. Key procedural issues include the absence of an observer accreditation process, restrictive definitions of observer categories, a ban on distributing observer documents during plenary, and an unusually burdensome 90-day nomination requirement. The rules prioritize barriers over access, with participation contingent on member nomination and consensus. This framework deviates from global governance norms, where observer engagement is considered essential to credibility, transparency, and accountability. Accountability.Fish characterized the secrecy surrounding ISC's processes as a political choice rather than a neutral stance. Literature from the transparency and governance fields consistently shows that civil society inclusion in scientific processes leads to improved sustainability outcomes. The principles of Open Science—transparency, sharing, and inclusivity—are presented as an emerging standard, with growing acknowledgment even within ISC that engaging broader stakeholders can enhance the scientific process. Accountability.Fish suggested that the current ISC model is increasingly outdated and in need of reform.

Monterey Bay Aquarium would like to thank the ISC Chair and Delegations for the opportunity to attend the Plenary Meeting and to provide comments. We would especially like to thank our host, Korea, for organizing a terrific meeting and social events. Similar to previous years, we would like to acknowledge all the work done by the working groups to provide precautionary scientific advice to managers and note the positive conservation impact this has had for many stocks. Particularly, we would like to commend the Bluefin and Albacore working groups for their completion of their respective MSEs and candidate harvest strategies. I urge the national delegations and ISC scientists to do what they can to push the Northern Committee and Joint Working Group for adoption of final harvest strategies for both these important stocks. To improve data reporting and compliance, the ISC should encourage the Northern Committee, WCPFC, and its representative states to adopt greater observer (human and electronic) coverage in chronically unobserved and under observed fisheries, particularly those operating on the high seas. Lastly, Monterey Bay Aquarium calls on the ISC to increase transparency throughout their operating process. This would include making it easier for outside experts to fully participate in working group discussions, increasing independent review of the working groups, and making non-confidential data available for review and use by outside scientists. We hope the ISC uses the upcoming external review process to develop new rules and procedures that increase transparency and participation by non-governmental scientists. Thank you for your time.

The Ocean Foundation thanks the ISC Chair and members for the opportunity to participate and commends the significant efforts of various working groups. On North Pacific Albacore, The Ocean Foundation emphasizes the importance of finalizing fishing intensity translation into actionable terms as the last step for effective harvest strategy implementation and urge timely action to avoid undermining progress. On Pacific Bluefin Tuna, The Ocean Foundation applauds the completion of the MSE and encourages adoption of a tested management procedure. For North Pacific Swordfish, The Ocean Foundation supports continued progress toward MSE development via external analyst, for which financial support should be secured. The Ocean Foundation also welcomes ISC's steps toward open science, including training workshops and public repositories, and encourages further transparency through timely document sharing, stakeholder access to technical meetings, and more inclusive observer participation. The Ocean Foundation supports making transparency and openness a focus of the upcoming ISC review.

WWF Japan was pleased to learn that the ISC has completed the MSE of the PBF as scheduled, and that the stock assessment peer review and response process for Pacific bluefin tuna and striped marlin is progressing, and that activities to increase transparency are being explored. As sustainable fisheries in the North Pacific are increasingly demanded, expectations for the ISC's contributions are growing. To meet these expectations, we recommend that the ISC reconfirm what data should be collected, particularly on bycatch and discards, and use electronic monitoring (EM) technology to quickly and accurately collect environmental and catch information to improve the accuracy of stock assessments and investigate the impacts of climate change.

20 ADOPTION OF REPORT

The Report of the ISC25 Plenary session was adopted by the members.

21 CLOSE OF MEETING

The meeting was closed at 11:00 AM June 20, 2025.

22 CATCH TABLES

Table 22-1 North Pacific albacore (*Thunnus alalunga*) retained and released catches (in metric tonnes) by ISC member fisheries, 1952-2024. “0”; Fishing effort was reported but no catch. “0” - Fishing effort was reported but no catch; “+” - Below 499kg catch; “-“ - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	CAN		JPN								KOR		MEX			TWN						USA									Total
		Troll	CAN Total	Set-net	Drift gill-net	Longline	Pole and line	Troll	Others	Purse seine	JPN Total	Longline	KOR Total	Others	Purse seine	MEX Total	Set-net	Gill-net (not specified)	Longline	Others	Purse seine	TWN Total	Drift gill-net	Handline	Longline	Pole and line	Troll	Others	Purse seine	Sport	USA Total	
Retain	1936																										442				442	442
	1937																										1,681				1,681	1,681
	1938																										8,594				8,594	8,594
	1939	129	129																								8,586				8,586	8,715
	1940	2	2																								6,603				6,603	6,605
	1941	35	35																								5,412				5,412	5,447
	1942																										10,678				10,678	10,678
	1943	13	13																								17,071				17,071	17,084
	1944	210	210																								23,957				23,957	24,167
	1945	648	648																								17,886				17,886	18,534
	1946	196	196																								10,955				10,955	11,151
	1947	36	36																								12,235				12,235	12,271
	1948	984	984																						45		22,457				22,502	23,486
	1949	1,012	1,012																						33		24,901				24,934	25,946
	1950	961	961																						27		32,746				32,773	33,734
	1951	86	86																						24		15,629				15,653	15,739
	1952	71	71	55	-	26,687	41,787	-	237	154	68,920			-	-	-									46		23,843			1,373	25,262	94,253
	1953	5	5	88	-	27,777	32,921	-	132	38	60,956			-	-	-									23		15,740			171	15,934	76,895
	1954			6	-	20,958	28,069	-	38	23	49,094			-	-	-									13		12,246			147	12,406	61,500
	1955			28	-	16,277	24,236	-	136	8	40,685			-	-	-									9		13,264			577	13,850	54,535
	1956	170	170	23	-	14,341	42,810	-	57	0	57,231			-	-	-									6		18,751			482	19,239	76,640
	1957	80	80	13	-	21,053	49,500	-	151	83	70,800			-	-	-									4		21,165			304	21,473	92,353
	1958	17	17	38	-	18,432	22,175	-	124	8	40,777			-	-	-									7		14,855			48	14,910	55,704
	1959	8	8	48	-	15,802	14,252	-	67	0	30,169			-	-	-									5		20,990			+	20,995	51,172
	1960	74	74	23	-	17,369	25,156	-	76	0	42,624			-	-	-									4		20,100			557	20,661	63,359
	1961	212	212	111	-	17,437	18,639	-	268	7	36,462			39	2	41									5	2,837	12,055	1		1,355	16,253	52,968
	1962	141	141	20	-	15,764	8,729	-	191	53	24,757			0	0	0									7	1,085	19,752	1		1,681	22,526	47,424
	1963	4	4	4	-	13,464	26,420	-	218	59	40,165			0	31	31									7	2,432	25,140			1,161	28,740	68,940
	1964	1	1	50	-	15,458	23,858	-	319	128	39,813			-	0	-									4	3,411	18,388			824	22,627	62,441
	1965	5	5	70	-	13,701	41,491	-	121	11	55,394			-	0	-									3	417	16,542	1		731	17,694	73,093
	1966	3	3	64	-	25,050	22,830	-	585	111	48,640			-	0	-									8	1,600	15,333			588	17,529	66,172
	1967	15	15	43	-	28,869	30,481	-	520	89	60,002			-	-	-	-	-	330	189		519			12	4,113	17,814			707	22,646	83,182
	1968	44	44	58	-	23,961	16,597	-	1,109	267	41,992			-	-	-	-	-	216	283		499			11	4,906	20,434			951	26,302	68,837
	1969	161	161	34	-	18,006	31,912	-	925	521	51,398			-	0	-	-	-	65	423		488			14	2,996	18,827			358	22,195	74,242
	1970	1,028	1,028	19	-	16,222	24,263	-	498	317	41,319			-	0	-	-	-	34	59		93			9	4,416	21,032			822	26,279	68,719
	1971	1,365	1,365	5	-	11,473	52,957	-	354	902	65,691	0	0	-	0	-	-	-	20	52		72			11	2,071	20,526			1,175	23,783	90,911
	1972	390	390	6	1	13,022	60,569	-	638	277	74,513	0	0	0	100	100	-	-	187	-		187			8	3,750	23,600			637	27,995	103,185
	1973	1,746	1,746	44	39	16,760	68,767	-	486	1,353	87,449	4	4	-	0	-	-	-	-	-		-			14	2,236	15,653			84	17,987	107,186
	1974	3,921	3,921	13	224	13,384	73,564	-	891	161	88,237	91	91	0	1	1	-	-	486	-		486			9	4,777	20,178			94	25,058	117,794
	1975	1,400	1,400	13	166	10,303	52,152	-	230	159	63,023	7,050	7,050	0	1	1	-	-	1,240	-		1,240			33	3,243	18,932	10		640	22,858	95,572
	1976	1,331	1,331	15	1,070	15,812	85,336	-	270	1,109	103,612	2,212	2,212	5	36	41	-	-	686	-		686			23	2,700	15,905	4		713	19,345	127,227
	1977	111	111	5	688	15,681	31,934	-	365	669	49,342	500	500	0	3	3	-	-	572	-		572			37	1,497	9,969			537	12,040	62,568
	1978	278	278	21	4,029	13,007	59,877	-	2,073	1,115	80,122	669	669	0	1	1	-	-	6	-		6			54	950	16,613	15		810	18,442	99,518
	1979	53	53	16	2,856	14,186	44,662	-	1,139	125	62,984	0	0	0	1	1	-	-	81	-		81				303	6,781			74	7,158	70,277
	1980	23	23	10	2,986	14,681	46,742	-	1,177	329	65,925	592	592	0	31	31	-	1	249	20		270				382	7,556			168	8,106	74,947
	1981	521	521	8	10,348	17,878	27,426	-	699	252	56,611	0	0	0	8	8	1	-	143	12		156			25	748	12,637			195	13,605	70,901
	1982	212	212	11	12,511	16,714	29,614	-	482	561	59,893	4,874	4,874	0	0	0	-	-	38	9		47			105	425	6,609	21		257	7,417	72,443
	1983	200	200	22	6,852	15,094	21,098	-	99	350	43,515	366	366	0	0	0	-	-	8	1		9			6	607	9,359			87	10,059	54,149
	1984	104	104	24	8,988	15,053	26,013	-	494	3,380	53,952	1,925	1,925	6	107	113	-	1	-	-		1			2	1,030	9,304		3,728	1,427	15,491	71,586
	1985	225	225	68	11,204	14,249	20,714	-	339	1,533	48,107	2,789	2,789	35	14	49	1	-	-	2		3	2				6,422	118	26	1,176	7,744	58,917
	1986	50	50	15	7,813	12,899	16,096	-	640	1,542	39,005	3,833	3,833	0	3	3	-	-	-	-		-	3				4,713	66	47	196	5,025	47,916
	1987	56	56	16	6,698	14,668	19,082	-	173	1,205	41,842	1,624	1,624	0	7	7	2	2,514	-	-		2,516	5		150		2,772	139	1	74	3,141	49,186
	1988	30	30	7	9,074	14,688	6,216	-	170	1,208	31,363	799	799	0	15	15	6	7,389	-	-		7,395	15		307		4,221	76	17	64	4,700	44,302
	1989	104	104	33	7,437	13,031	8,629	-	433	2,521	32,084	561	561	0	2	2	-	8,350	40	-		8,390	4		248		1,896	10	1	160	2,319	43,460
	1990	155	155	5	6,064	15,785	8,532	-	248	1,995	32,629	29	29	0	2	2	-	16,701	4	39		16,744	29		177		2,733	20	71	24	3,054	52,613
	1991	140	140	4	3,401	6,664	7,103	-	395	2,652	20,219	4	4	0	2	2	-	3,398	12	-		3,410	17		312		1,917	20		6	2,272	26,047
	1992	302	302	12	2,721	19,042	13,888	-	1,522	4,104	41,289	1	1	0	10	10	-	7,866	-	-		7,866			334		4,626	40		2	5,002	54,470
	1993	139	139	3	287	29,933	12,797	-	897	2,889	46,806	2	2	0	11	11	-	-	5	-		5			438		6,325	194		25	6,982	53,945
	1994	1,998	1,998	11	263	29,565	26,389	-	823	2,026	59,077	2	2	0	6	6	-	-	83	-		83	38		544		11,068	66		106	11,822	72,988
	1995	1,761	1,761	28	282	29,050	20,981	856	78	1,177	52,452	13	13	0	5	5	-	-	4,280	-		4,280	52		882		8,302	4		102	9,342	67,853
	1996	3,321	3,321	43	116	32,440	20,272	815	127	581	54,394	157	157	0	21	21	-	-	7,596	-	-	7,596	83		1,185		17,150	10	11	88	18,527	84,016
	1997	2,166	2,166	40	359	38,899	32,238	1,585	135	1,068	74,324	404	404	0	53	53	-	-	9,456	-	-	9,456	60		1,653		14,458	12	2	1,018	17,203	103,606
	1998	4,177	4,177	41	206	35,755	22,926	1,190	104	1,554	61,776	225	225	0	8	8	-	-	8,810	-	-	8,810	80		1,120		14,577	15	33	1,208	17,033	92,029
	1999	2,734	2,734	90	289	33,339	50,369	891	62	6,872	91,912	98	98	57	0	57	-	-	8,393	-	-	8,393	149		1,542		10,451	61	48	3,621	15,872	119,066
	2000	4,531	4,531	136	67	29,995	21,550	645	86	2,408	54,887	15	15	33	70	103	-	-	8,842	-	-	8,842	55		940		9,834	24	4	1,798	12,655	81,033
	2001	5,248	5,248	78	117	28,801	29,430	416	35	974	59,851	63	63	18	0	18	-	1	8,684	+	-	8,685	94		1,295		11,543	39	51	1,635	14,657	88,522
	2002	5,379	5,379	109	332	23,585	48,454	787	85	3,303	76,655	111	111	0	28	28	-	-	7,965	-	-	7,965	30		525		11,003	13	4	2,357	13,932	104,070
	2003	6,847	6,847	69	126	20,907	36,114	922	85	627	58,850	146	146	0	29	29	-	-	7,166	-	-	7,166	16		524		14,246	8	44	2,214	17,052	90,090
	2004	7,857	7,857	30	61	17,341	32,255	772	54	7,200	57,713	77	77	0	104	104	-	-	4,988	-	-	4,988	12		361		13,630	3	1	1,506	15,513	86,252
	2005	4,829	4,829	97	154	20,465	16,133	665	234	850	38,598	419	419	0	0	0	-	-	4,472	-	-	4,472	20		296		8,654	1		1,719	10,690	59,008
	2006	5,833	5,833	55	221	21,168	15,400	460	42	364	37,710	134	134	0	109	109	-	-	4,317	-	-	4,317	3		270		12,642	+		385	13,300	61,403
	2007	6,040	6,040	30	226	22,381	37,768	519	44	5,682	66,650	136	136	0	40	40	-	+	2,916	-	-	2,916	4	94	250		11,911	+	77	461	12,797	88,579
	2008	5,464	5,464	101	1,531	19,092	19,060	549	34	825	41,192	400	400	-	10	10	-	-	3,069	-	-	3,069	1	28	354		11,762	+		418	12,563	62,698
	2009	5,693	5,693	33	149	21,995	31,172	410	43	2,076	55,878	95	95	-	17	17	-	-	2,378	-	-	2,378	4	97	203		12,343	+	31	944	13,622	77,683
	2010	6,527	6,527	42	24	21,167	19,561	588	37	330	41,749	107	107	-	25	25	+	-	2,818	-	-	2,818	5	53	421		11,691	0		862	13,032	64,258
	2011	5,385	5,385	50	12	20,956	25,704	443	78	480	47,723	78	78	-	0	-	+	1	3,434	2	-	3,437	5	84	708		10,147	0		421	11,365	67,988
	2012	2,484	2,484	48	26	22,828	33,742	610	129	4,193	61,576	156	156	0	0	0	2	2	2,643	-	-	2,647	8	253	660		14,152	2		1,212	16,287	83,150
	2013	5,088	5,088	36	14	19,839	33,568	302	211	1,988	55,958	173	173		0	0	1	+	4,427	-	-	4,428	5	46	317		12,312	0		839	13,519	79,166
	2014	4,780	4,780	24	11	19,973	29,433	197	197	2,009	51,844	116	116		0	0	1	1	2,617	+	-	2,619	+	49	209		13,401			1,042	14,700	74,060
	2015	4,391	4,391	17	138	21,013	21,294	239	167	1,072	43,940	38	38		0	0	1	2	3,020	4	-	3,027	1	62	227		11,597	2		932	12,820	64,216
	2016	2,842	2,842	28	19	16,549	14,435	148	128	3,679	34,986	56	56		0	0	+	+	3,406	-	-	3,406	1	24	248		10,759	0		675	11,708	52,998
	2017	1,831	1,831	48	40	17,309	20,891	107	119	1,251	39,765	202	202		0	0	-	5	4,333	-	-	4,338	0	35	95		7,432	14		372	7,947	54,084
	2018	2,717	2,717	13	35	13,192	17,875	78	70	3,039	34,302	101	101				-	-	4,514	+	-	4,514		20	87		7,729			381	8,217	49,851
	2019	2,402	2,402	27	9	12,216	8,508	543	95	1,045	22,443	65	65				-	5	5,454	+	1	5,460		10	104		7,745	4		1,364	9,226	39,596
	2020	2,376	2,376	25	7	12,694	36,634	784	159	5,961	56,264	56	56				1	-	3,809	-	-	3,810		3	147		7,530	8		260	7,947	70,453
	2021	2,419	2,419	11	3	18,327	11,136	428	232	92	30,229	275	275				-	+	5,953	+	-	5,953		5	226		4,664	2		248	5,146	44,022
	2022	3,639	3,639	18	31	11,033	4,090	216	159	726	16,273	173	173				-	+	4,860	+	-	4,860	1	5	202		9,080	3		587	9,877	34,822
	2023	1,151	1,151	34	8	14,201	14,006	1,038	231	3,098	32,616	113	113				-	+	6,651	+	-	6,651		5	506		3,651	9		567	4,738	45,269
	2024	2,888	2,888	34	8	14,201	14,006	1,038	231	3,098	32,616	474	474				-	+	9,231	+	-	9,231		29	244		4,699	5	1	865	5,843	51,052
Retain catch total		144,005	144,005	2,617	110,341	1,390,911	2,085,288	18,241	24,300	######	3,733,614	32,603	32,603	193	913	1,106	16	46,237	165,007	1,095	1	212,356	801	903	18,962	52,932	1,125,514	1,041	4,198	51,668	1,256,018	5,379,702
Release	2013	1	1																													1
	2014	7	7																													7
	2015	14	14																													14
	2016	2	2																													2
	2017	2	2																													2
	2018	18	18									+	+																			18
	2019	13	13																													13
	2020	2	2																													2
	2021	22	22									0	0																			22
	2022	5	5									0	0																			7
	2023	9	9																													9
	2024	6	6																													6
Release total		101	101									+	+																			97
Total		144,106	144,106	2,617	110,341	1,390,911	2,085,288	18,241	24,300	######	3,733,614	32,603	32,603	193	913	1,106	16	46,237	165,007	1,095	1	212,356	801	903	18,962	52,932	1,125,514	1,041	4,198	51,668	1,256,018	5,379,799

Table 22-2 Pacific bluefin tuna (*Thunnus orientialis*) retained and released catches (in metric tonnes) by ISC member fisheries, 1952-2024. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

		JPN							KOR					MEX				TWN							USA									
Catch disposition	Year	Set-net	Longline	Pole and line	Troll[1]	Others	Purse seine	JPN Total	Set-net	Longline	Purse seine	Trawl	KOR Total	Others	Purse seine	Sport	MEX Total	Set-net	Gill-net (not specified)	Drift gill-net	Longline	Others	Purse seine	TWN Total	Drift gill-net	Longline	Pole and line	Troll	Hook and Line	Others	Purse seine	Sport	USA Total[4]	Total
Retain	1952	2,145	2,694	2,198	667	1,700	7,680	17,084						-	-		-														2,076	2	2,078	19,162
	1953	2,335	3,040	3,052	1,472	160	5,570	15,629						-	-		-														4,433	48	4,481	20,110
	1954	5,579	3,088	3,044	1,656	266	5,366	18,999						-	-		-														9,537	11	9,548	28,547
	1955	3,256	2,951	2,841	1,507	1,151	14,016	25,722						-	-		-														6,173	93	6,266	31,988
	1956	4,170	2,672	4,060	1,763	385	20,979	34,029						-	-		-														5,727	388	6,115	40,144
	1957	2,822	1,685	1,795	2,392	414	18,147	27,255						-	-		-														9,215	73	9,288	36,543
	1958	1,187	818	2,337	1,497	215	8,586	14,640						-	-		-														13,934	10	13,944	28,584
	1959	1,575	3,136	586	736	167	9,996	16,196						32	171		203										56				3,506	13	3,575	19,974
	1960	2,032	5,910	600	1,885	369	10,541	21,337						-	-		-										+				4,547	1	4,548	25,885
	1961	2,710	6,364	662	3,193	599	9,124	22,652						-	130		130										16				7,989	23	8,028	30,810
	1962	2,545	5,769	747	1,683	293	10,657	21,694						-	294		294										+				10,769	25	10,794	32,782
	1963	2,797	6,077	1,256	2,542	294	9,786	22,752						-	412		412										28				11,832	7	11,867	35,031
	1964	1,475	3,140	1,037	2,784	1,884	8,973	19,293						-	131		131										39				9,047	7	9,093	28,517
	1965	2,121	2,569	831	1,963	1,106	11,496	20,086						-	289		289				54			54			11	+		66	6,523	1	6,601	27,030
	1966	1,261	1,370	613	1,614	129	10,082	15,069						-	435		435				-			-			12				15,450	20	15,482	30,986
	1967	2,603	878	1,210	3,273	302	6,462	14,728						-	371		371				53			53			+				5,517	32	5,549	20,701
	1968	3,058	500	983	1,568	217	9,268	15,594						-	195		195				33			33			8				5,773	12	5,793	21,615
	1969	2,187	878	721	2,219	195	3,236	9,436						-	260		260				23			23			9				6,657	15	6,681	16,400
	1970	1,779	607	723	1,198	224	2,907	7,438						-	92		92				-			-			+				3,873	19	3,892	11,422
	1971	1,555	697	938	1,492	317	3,721	8,720		0			0	-	555		555				1			1			+				7,804	8	7,812	17,088
	1972	1,107	512	944	842	197	4,212	7,814		0			0	-	1,646		1,646				14			14			3			42	11,656	15	11,716	21,190
	1973	2,351	838	526	2,108	636	2,266	8,725		0			0	-	1,084		1,084				33			33			5	+		20	9,639	54	9,718	19,560
	1974	6,019	1,177	1,192	1,656	754	4,106	14,904		0			0	-	344		344				47	15		62			+	+		30	5,243	58	5,331	20,641
	1975	2,433	1,061	1,401	1,031	808	4,491	11,225		3			3	-	2,145		2,145				61	5		66			83			1	7,353	34	7,471	20,910
	1976	2,996	320	1,082	830	1,237	2,148	8,613		5			5	-	1,968		1,968				17	2		19			22	+		3	8,652	21	8,698	19,303
	1977	2,257	338	2,256	2,166	1,052	5,110	13,179		0			0	-	2,186		2,186				131	2		133			10			3	3,259	19	3,291	18,789
	1978	2,546	648	1,154	4,517	2,276	10,427	21,568		3			3	-	545		545				66	2		68			4			2	4,663	5	4,674	26,858
	1979	4,558	729	1,250	2,655	2,429	13,881	25,502		0			0	-	213		213				58	-		58			5			1	5,889	11	5,906	31,679
	1980	2,521	811	1,392	1,531	1,953	11,327	19,535		0			0	-	582		582				114	5		119			+			24	2,327	7	2,358	22,594
	1981	2,129	590	754	1,777	2,653	25,422	33,325		0			0	-	218		218				179	-		179	4		+	10		+	867	9	890	34,612
	1982	1,667	718	1,777	864	1,709	19,234	25,969		0	31		31	-	506		506			2	207	-		209	9		1			+	2,639	11	2,660	29,375
	1983	972	217	356	2,028	1,117	14,774	19,464		0	13		13	-	214		214			2	175	-	9	186	31		59			2	629	33	754	20,631
	1984	2,234	142	587	1,874	868	4,433	10,138		1	4		5	-	166		166			-	477	8	5	490	6	1	5			18	673	49	752	11,551
	1985	2,562	105	1,817	1,850	1,175	4,154	11,663		0	1		1	-	676		676			11	210	-	80	301	8					20	3,320	89	3,437	16,078
	1986	2,914	102	1,086	1,467	719	7,412	13,700		0	344		344	-	189		189			13	70	-	16	99	16					41	4,851	12	4,920	19,252
	1987	2,198	211	1,565	880	445	8,653	13,952		13	89		102	-	119		119			14	365	-	21	400	2					18	861	34	915	15,488
	1988	843	157	907	1,124	498	3,605	7,134		0	32		32	1	447		448			37	108	25	197	367	4					46	923	6	979	8,960
	1989	748	209	754	903	283	6,190	9,087		0	71		71	-	57		57			51	205	3	259	518	3					18	1,046	112	1,179	10,912
	1990	716	267	536	1,250	455	2,989	6,213		0	132		132	-	50		50			299	189	16	149	653	11					81	1,380	65	1,537	8,585
	1991	1,485	218	286	2,069	650	9,808	14,516		0	265		265	-	9		9			107	342	12	-	461	4	2				+	410	92	508	15,759
	1992	1,208	513	166	915	1,081	7,162	11,045		0	288		288	-	0		0			3	464	5	73	545	9	38				14	1,928	110	2,099	13,977
	1993	848	812	129	546	365	6,600	9,300		0	40		40	-	0		0				471	3	1	475	32	42				29	580	283	966	10,781
	1994	1,158	1,206	162	4,111	398	8,131	15,166		0	50		50	2	63		65				559	-		559	28	30				1	906	86	1,051	16,891
	1995	1,859	678	270	4,778	586	18,909	27,080		0	821		821	-	11		11				335	2		337	20	29				+	657	245	951	29,200
	1996	1,149	901	94	3,640	570	7,644	13,998		0	102		102	-	3,700		3,700	-	-		956	-	-	956	43	25		2		+	4,639	40	4,749	23,505
	1997	803	1,300	34	2,740	811	13,152	18,840		0	1,054		1,054	-	367		367	-	-		1,814	-	-	1,814	58	26		1		48	2,240	131	2,504	24,579
	1998	874	1,255	85	2,876	700	5,391	11,181		0	188		188	-	1		1	-	-		1,910	-	-	1,910	40	54		128		59	1,771	422	2,474	15,754
	1999	1,097	1,157	35	3,440	709	16,173	22,611		0	256		256	35	2,369		2,404	-	-		3,089	-	-	3,089	22	54		20		88	184	408	776	29,136
	2000	1,125	953	102	5,217	689	16,486	24,572		0	2,401	0	2,401	99	3,019		3,118	-	1		2,780	1	-	2,782	30	19		1		11	693	319	1,073	33,946
	2001	1,366	791	180	3,466	782	7,620	14,205		0	1,176	10	1,186	-	863		863	-	2		1,839	2	-	1,843	35	6		6		1	292	344	684	18,781
	2002	1,100	841	99	2,607	631	8,903	14,181		0	932	1	933	2	1,708		1,710	-	3		1,523	1	-	1,527	7	2		1		2	50	613	675	19,026
	2003	839	1,237	44	2,060	446	5,768	10,394		0	2,601	0	2,601	43	3,211		3,254	-	10		1,863	11	-	1,884	14	1				3	22	355	395	18,528
	2004	896	1,847	132	2,445	514	8,257	14,091		0	773	0	773	14	8,880		8,894	-	1		1,714	2	-	1,717	10	1				+		50	61	25,536
	2005	2,182	1,925	549	3,633	548	12,817	21,654		0	1,318	9	1,327	-	4,542		4,542	1	-		1,368	1	-	1,370	5	1				1	201	73	281	29,174
	2006	1,421	1,121	108	1,860	777	8,880	14,167		0	1,012	3	1,015	-	9,806		9,806	1	-		1,149	-	-	1,150	1	1				+		94	96	26,234
	2007	1,503	1,762	236	2,823	657	6,840	13,821		0	1,281	4	1,285	-	4,147		4,147	2	8		1,401	-	-	1,411	2	+				+	42	12	56	20,720
	2008	2,358	1,390	64	2,377	770	10,221	17,180		0	1,866	10	1,876	15	4,407		4,422	1	1		979	-	-	981	1	+				+		63	64	24,523
	2009	2,236	1,080	50	2,003	575	8,077	14,021		0	936	4	940	-	3,019		3,019	1	10		877	-	-	888	3	1		0		2	410	156	572	19,440
	2010	1,603	890	83	1,583	495	3,742	8,396		0	1,196	16	1,212	-	7,746		7,746	29	7		373	-	-	409	1	0				0		88	89	17,852
	2011	1,651	837	63	1,820	283	8,340	12,993		0	670	14	684	1	2,731		2,732	16	7		292	1	-	316	18	0		0		100		225	343	17,068
	2012	1,932	673	113	570	343	2,462	6,093		0	1,421	2	1,423	1	6,668		6,669	2	-		210	2	-	214	4	0		0		38		400	442	14,841
	2013	1,415	784	8	904	529	2,771	6,411	1	-	604	0	605		3,154		3,154	2	1		331	-	-	334	7	1		0		3		809	820	11,324
	2014	1,907	683	5	1,023	499	5,456	9,573	6		1,305	-	1,311		4,862		4,862	38	4		483	-	-	525	5	+		+	2	-	401	420	828	17,099
	2015	1,242	648	8	413	431	3,645	6,386	1		676		677		3,082		3,082	25	1		552	-	-	578	4	+			7	-	86	400	498	11,221
	2016	1,228	691	54	778	508	5,095	8,354	3		1,024	2	1,030		2,709		2,709	-	+		454	-	-	454	9	1		0	31	-	316	372	728	13,275
	2017	2,221	913	49	605	665	4,540	8,993	3		734	6	743		3,643		3,643	-	-		415	+	-	415	1	1		+	18	+	466	463	950	14,744
	2018	645	700	9	371	431	4,049	6,205	7		523	5	535		2,840		2,840	+	3		381	+	-	384	18	1		+	31	4	12	535	600	10,565
	2019	951	1,002	+	720	372	4,464	7,509	36		542	3	581		2,249		2,249	2	2		486	2	-	492	10	2		1	36	1	226	483	758	11,589
	2020	1,342	1,416	1	759	531	3,960	8,009	35		567	3	605		3,285		3,285	1	-		1,149	-	-	1,150	28	2		+	87	1	116	742	975	14,024
	2021	1,742	1,512	0	661	513	4,199	8,627	84		422	3	509		3,027		3,027	+	+		1,478	-	-	1,478	55	1		+	116	3	43	1,294	1,512	15,153
	2022	2,126	1,599	13	1,051	591	4,702	10,082	221		654	6	881		3,194	22	3,216	1	+		1,490	-	-	1,491	20	2		0	149	1	198	1,612	1,982	17,652
	2023	1,889	1,557	24	1,171	602	4,570	9,813	215		448	5	668	8	3,399	11	3,418	4	1		2,116	-	-	2,121	16	2		+	163	2	3	2,019	2,206	18,226
	2024	1,537	1,550	6	1,370	649	4,614	9,726	307		440	22	768	27	3,531	4	3,562	4	1		2,259	-	-	2,264	4	3		0	130	1		1,385	1,523	17,843
Retain catch total		141,901	100,437	54,831	135,861	51,353	594,874	1,079,257	613	25	28,863	106	29,607	280	122,932	37	123,249	130	63	539	40,792	128	810	42,462	659	348	376	170	770	849	243,145	16,594	262,910	1,537,484
Total		141,901	100,437	54,831	135,861	51,353	594,874	1,079,257	613	25	28,863	106	29,607	280	122,932	37	123,249	130	63	539	40,792	128	810	42,462	659	348	376	170	770	849	243,145	16,594	262,910	1,537,484

Table 22-3 Annual retained and released catches of swordfish (*Xiphias gladius*) in metric tonnes for fisheries monitored by ISC members for assessments of the North Pacific Ocean stock, 1951-2024. “0”; Fishing effort was reported but no catch. “0” - Fishing effort was reported but no catch; “+” - Below 499kg catch; “-“ - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

		JPN						KOR			MEX			TWN							USA										
Catch disposition	Year	Set-net	Drift gill-net	Longline	Others	Not specified	JPN Total	Longline	Purse seine	KOR Total	Others	Sport	MEX Total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN Total	Drift gill-net	Harpoon	Handline	Longline	Pole and line	Troll	Hook-and-line	Other	Purse-seine	USA Total	Total
Retain	1951	78	10	7,361	4,131	98	11,678																								11,678
	1952	68	-	9,042	2,569	12	11,691																								11,691
	1953	21	-	10,873	1,407	107	12,408										-			-											12,408
	1954	18	-	12,659	813	121	13,611										-			-											13,611
	1955	37	-	13,093	821	160	14,111										-			-											14,111
	1956	31	-	14,606	775	73	15,485										-			-											15,485
	1957	18	-	14,305	858	70	15,251										-			-											15,251
	1958	31	-	18,567	1,069	67	19,734										-			-											19,734
	1959	31	-	17,302	891	44	18,268										427			427											18,695
	1960	67	1	20,109	1,191	30	21,398										520			520											21,918
	1961	15	2	19,766	1,335	30	21,148										318			318											21,466
	1962	15	-	10,685	1,371	44	12,115										494			494											12,609
	1963	17	-	10,420	747	59	11,243										343			343											11,586
	1964	16	4	7,760	1,006	66	8,852										358			358											9,210
	1965	14	-	8,861	1,908	208	10,991										331			331											11,322
	1966	11	-	9,979	1,728	45	11,763										489			489											12,252
	1967	12	-	11,067	891	38	12,008							-	-	5	646	30		681											12,689
	1968	14	-	10,046	1,539	50	11,649							-	8	3	763	1		775											12,424
	1969	11	-	9,712	1,557	56	11,336							-	1	6	843	-		850											12,186
	1970	9	-	7,751	1,748	39	9,547							-	1	5	904	-		910		612		5						617	11,074
	1971	37	1	7,387	473	48	7,946	0		0				-	-	3	992	-		995		99		1						100	9,041
	1972	1	55	7,327	282	22	7,687	0		0				-	-	12	862	-		874		171								171	8,732
	1973	23	720	7,574	121	29	8,467	0		0				-	-	113	860	6		979		399								399	9,845
	1974	16	1,304	6,669	190	29	8,208	0		0				-	-	98	881	38		1,017		406								406	9,631
	1975	18	2,672	7,677	205	60	10,632	0		0				-	-	152	928	1		1,081		557								557	12,270
	1976	14	3,488	8,845	313	182	12,842	0		0				-	-	159	636	35		830		42								42	13,714
	1977	7	2,344	9,301	201	73	11,926	0		0				-	2	139	578	-		719		318		17						335	12,980
	1978	22	2,475	9,069	130	111	11,807	0		0				-	3	10	546	-		559		1,699		9						1,708	14,074
	1979	15	983	9,692	161	49	10,900	0		0				-	5	24	668	4		701		329		7						336	11,937
	1980	15	1,746	6,898	398	30	9,087	135		135				-	4	72	613	1		690	160	566		5						731	10,643
	1981	9	1,848	7,841	129	61	9,888	0		0				-	3	18	658	4		683	473	271		3	2					749	11,320
	1982	7	1,257	6,998	195	59	8,516	166		166				-	3	46	856	-		905	945	156		5	3	6		1		1,116	10,703
	1983	9	1,033	8,752	166	32	9,992	47		47				-	3	164	783	-		950	1,693	58		5	2	3		1	1	1,763	12,752
	1984	13	1,053	8,411	117	98	9,692	27		27				43	5	259	733	-		1,040	2,647	104		15	49				26	2,841	13,600
	1985	10	1,133	10,387	191	69	11,790	12		12				3	29	166	566	61		825	2,990	305	4	2				104		3,405	16,032
	1986	9	1,264	9,815	123	47	11,258	18		18				3	1	201	456	6		667	2,069	291	4	2				109		2,475	14,418
	1987	11	1,051	10,411	87	45	11,605	50		50				-	-	187	1,331	3		1,521	1,529	235	4	24				31		1,823	14,999
	1988	8	1,234	9,317	173	19	10,751	27		27				-	1	80	777	183		1,041	1,376	198	6	24				64		1,668	13,487
	1989	10	1,596	7,492	362	21	9,481	7		7				3	2	61	1,541	35		1,642	1,243	62	7	218				56		1,586	12,716
	1990	4	1,074	6,598	128	13	7,817	46		46		-	-	4	2	118	1,452	88		1,664	1,131	64	5	2,437				43		3,680	13,207
	1991	5	498	5,690	153	20	6,366	37		37		-	-	4	2	205	1,430	56		1,697	944	20	6	4,535				44		5,549	13,649
	1992	6	887	8,505	381	16	9,795	32		32		-	-	12	1	287	1,494	33		1,827	1,356	75	1	5,762				47		7,241	18,895
	1993	4	292	9,777	309	44	10,426	27		27		-	-	13	3	194	1,228	100		1,538	1,412	168	4	5,936				161		7,681	19,672
	1994	4	421	8,723	308	37	9,493	4		4		-	-	12	3	211	1,155	9		1,390	792	157	4	3,807				24		4,784	15,671
	1995	7	561	7,809	423	34	8,834	9		9		-	-	6	2	14	1,185	203		1,410	771	97	6	2,981				29		3,884	14,137
	1996	4	428	7,983	597	45	9,057	15		15		-	-	10	2	19	710	1	-	742	761	81	5	2,848				15		3,710	13,524
	1997	5	365	8,216	346	62	8,994	99		99		-	-	8	1	27	1,397	1	-	1,434	708	84	7	3,393				11		4,203	14,730
	1998	2	471	7,423	476	68	8,440	153		153		-	-	15	9	17	1,198	-	-	1,239	931	48	7	3,681				19		4,686	14,518
	1999	5	724	6,606	416	47	7,798	131		131		-	-	5	5	51	1,455	+	-	1,516	606	81	9	4,329				27		5,052	14,497
	2000	5	808	7,301	497	49	8,660	202		202	602	-	602	5	6	74	3,716	-	-	3,801	649	90		4,834				33		5,606	18,871
	2001	15	732	7,840	230	30	8,847	438		438	516	-	516	8	18	64	4,853	-	-	4,943	375	52		1,969				19		2,415	17,159
	2002	11	1,164	7,195	201	29	8,600	438		438	215	-	215	16	8	1	5,400	1	-	5,426	302	90		1,524				3		1,919	16,598
	2003	4	1,198	6,439	149	28	7,818	380		380	237	-	237	8	3	-	4,771	-	-	4,782	216	107	10	1,958				11		2,302	15,519
	2004	4	1,062	6,904	229	30	8,229	410		410	268	-	268	7	6	1	4,248	2	-	4,264	182	69	7	1,185				44		1,487	14,658
	2005	3	956	6,653	187	337	8,136	403		403	234	-	234	5	3	16	3,964	2	-	3,990	220	77	5	1,622				5		1,929	14,692
	2006	5	796	7,690	244	343	9,078	465		465	328	-	328	7	2	49	4,382	3	-	4,443	443	71	4	1,211				5		1,734	16,048
	2007	2	829	8,125	122	368	9,446	453		453	172	-	172	2	2	20	4,099	2	-	4,125	490	59	5	1,735		1				2,290	16,486
	2008	3	648	6,189	173	349	7,362	794		794	242	-	242	3	6	39	3,745	+	-	3,793	405	48	6	2,014				19		2,492	14,683
	2009	3	682	6,007	239	249	7,180	993		993	394	-	394	83	7	31	3,550	-	-	3,671	253	50	5	1,817		0		0		2,125	14,363
	2010	8	494	5,400	110	230	6,242	662		662	222	-	222	6	4	42	2,844	-	-	2,896	62	37	3	1,676				18		1,796	11,818
	2011	2	193	4,022	10	233	4,460	962		962	-	-	-	8	17	52	3,577	1	+	3,655	119	24	5	1,623				90		1,861	10,938
	2012	8	371	4,034	59	288	4,760	856		856	-	-	-	3	15	30	3,746	+	-	3,794	118	5	6	1,395		1		1		1,526	10,936
	2013	13	290	4,248	163	291	5,005	1,071		1,071	-	-	-	2	8	-	2,846	1	-	2,857	95	6	6	1,270		1		7		1,385	10,318
	2014	7	269	4,381	0	291	4,948	829		829	-	-	-	4	4	-	2,817	+	+	2,825	127	6	7	1,665		1	0	4		1,811	10,413
	2015	3	277	5,099	204	281	5,864	776		776		-	-	4	4	-	3,199	-	-	3,207	101	5	5	1,515		1	0	12		1,639	11,486
	2016	2	303	5,605	169	256	6,335	582		582		-	-	2	3	+	2,054	1	-	2,059	183	26	4	1,092			1	42		1,348	10,324
	2017	3	291	4,837	274	289	5,694	583		583				+	3	-	2,194	+	+	2,197	180	28	6	1,618		+	1	44		1,876	10,350
	2018	5	230	5,015	480	267	5,997	708		708				1	+	-	2,124	+	-	2,125	148	10	3	1,053		1	0	67		1,281	10,111
	2019	6	242	3,910	339	210	4,707	468		468				2	0	0	2,113	0	0	2,115	52	11	3	734		0	1	186		987	8,278
	2020	7	290	5,007	179	305	5,788	312		312				3	+	-	1,868	+	-	1,871	35	6	2	728			1	124		896	8,867
	2021	4	301	3,312	270	251	4,138	267		267				1	-	-	1,067	-	-	1,068	14	7	1	971		+	2	54		1,049	6,522
	2022	4	459	2,802	313	283	3,861	447		447				1	-	-	1,108	3	-	1,112	29	33	1	1,307		+	2	27		1,399	6,819
	2023	4	631	4,152	234	225	5,246	590		590				1	-	-	1,564	+	+	1,565	37	36	1	1,219			1	31		1,325	8,726
	2024	4	631	4,265	234	225	5,359	337		337				1	-	-	1,304	+	+	1,305	24	19	1	1,018		+	1	9		1,072	8,073
tain catch total		969	47,142	#######	41,218	8,624	#######	15,131		15,131	3,430	0	3,430	324	220	3,545	#######	914	0	#######	29,393	8,725	176	78,803	56	16	12	1,642	27	#######	969,514
Release	2010																												0	0	0
	2011																												0	0	0
	2018							+		+																					+
	2019							+		+																					+
	2020							+		+																					+
	2021							0		0																					0
	2022							+		+																					+
	2023							0	0	0																					0
	2024							1		1																					
Release total								1	0	1																			0	0	1
Total		969	47,142	#######	41,218	8,624	#######	15,132	0	15,132	3,430	0	3,430	324	220	3,545	#######	914	0	#######	29,393	8,725	176	78,803	56	16	12	1,642	27	#######	969,515

Table 22-4 Annual retained and released catches of striped marlin (*Kajikia audax*) in metric tonnes for fisheries monitored by ISC members for assessments of the WCNPO stock, 1951-2024. “0” - Fishing effort was reported but no catch; “+” - Below 499kg catch; “-“ - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN						KOR			MEX		TWN							USA							Total
		Set-net	Drift gill-net	Longline	Others	Not specified	JPN Total	Longline	Purse seine	KOR Total	Sport	MEX Total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN Total	Handline	Longline	Troll	Others	Purse seine	Sport	USA Total	
Retain	1951	92	-	3,167	1,149	39	4,447																				4,447
	1952	203	-	3,623	1,321	40	5,187																		23	23	5,210
	1953	126	-	2,185	793	36	3,140										0		0						5	5	3,145
	1954	82	-	3,120	938	67	4,207										0		0						16	16	4,223
	1955	106	-	3,110	850	82	4,148										0		0						5	5	4,153
	1956	133	-	3,788	1,822	41	5,784										0		0						34	34	5,818
	1957	71	-	3,308	2,312	76	5,767										0		0						42	42	5,809
	1958	82	3	4,383	2,704	127	7,299									543	387		930						59	59	8,288
	1959	87	2	4,308	2,905	200	7,502									391	354		745						65	65	8,312
	1960	161	4	3,963	1,689	87	5,904									398	350		748						30	30	6,682
	1961	161	2	4,589	1,538	98	6,388									306	342		648						24	24	7,060
	1962	197	8	5,849	1,607	108	7,769									332	211		543						5	5	8,317
	1963	92	17	6,197	1,527	292	8,125									560	199		759						68	68	8,952
	1964	81	2	14,346	2,223	41	16,693									392	175		567						58	58	17,318
	1965	81	1	11,621	2,640	73	14,416									355	157		512						23	23	14,951
	1966	226	2	8,531	1,313	31	10,103									370	180		550						36	36	10,689
	1967	82	3	11,825	1,394	75	13,379						-	0	141	387	63		591						49	49	14,019
	1968	71	0	16,143	914	58	17,186						-	40	134	333	34		541						51	51	17,778
	1969	71	3	9,147	2,516	81	11,818						-	5	159	573	28		765						30	30	12,613
	1970	55	3	13,867	824	153	14,902						-	8	175	495	6		684						18	18	15,604
	1971	61	10	11,891	1,674	307	13,943	0		0			-	16	101	449	18		584						17	17	14,544
	1972	72	243	7,988	827	94	9,224	0		0			-	1	124	389	1		515						21	21	9,760
	1973	80	3,265	7,107	476	146	11,074	0		0			-	4	115	569	20		708						9	9	11,791
	1974	90	3,112	7,076	581	104	10,963	0		0			-	7	53	674	58		792						55	55	11,810
	1975	105	6,534	5,605	492	89	12,825	0		0			-	7	86	796	3		892						27	27	13,744
	1976	37	3,561	5,414	441	107	9,560	0		0			-	9	61	379	70		519						31	31	10,110
	1977	103	4,424	3,290	337	107	8,261	0		0			-	9	207	541	3		760						41	41	9,062
	1978	93	5,593	4,227	210	243	10,366	0		0			-	7	70	618	1		696						37	37	11,099
	1979	66	2,532	5,948	327	133	9,006	0		0			2	18	104	458	0		582						36	36	9,624
	1980	80	3,467	6,990	397	59	10,993	73		73			-	39	92	284	1		416						33	33	11,515
	1981	88	3,866	4,377	385	69	8,785	0		0			-	25	70	508	0		603						60	60	9,448
	1982	52	2,351	5,666	476	128	8,673	102		102			-	26	112	404	0		542						41	41	9,358
	1983	124	1,867	4,052	547	156	6,746	49		49			-	31	144	555	39		769						39	39	7,603
	1984	144	2,333	3,901	398	177	6,953	39		39			-	16	314	965	0		1,295						36	36	8,323
	1985	81	2,363	4,632	499	153	7,728	13		13			1	6	152	513	23		695			18			42	60	8,496
	1986	131	3,584	7,336	343	103	11,497	14		14			-	13	119	179	16		327			19			19	38	11,876
	1987	102	1,888	8,731	244	167	11,132	15		15			1	2	132	414	16		565	1	272	29			28	330	12,042
	1988	63	2,211	7,030	400	205	9,909	16		16			7	12	70	464	80		633		504	54			30	588	11,146
	1989	47	1,664	5,834	345	145	8,035	24		24			-	23	124	192	10		349	+	612	24			52	688	9,096
	1990	65	1,945	3,496	287	193	5,986	1		1	-	-	12	16	207	139	21		395	+	538	27			23	588	6,970
	1991	56	1,329	4,045	320	131	5,881	7		7	-	-	-	81	173	290	32		576	+	663	41			12	716	7,180
	1992	71	1,204	4,212	137	95	5,719	53		53	-	-	-	11	163	220	24		418	1	459	37			25	522	6,712
	1993	27	828	5,200	308	373	6,736	568		568	-	-	3	7	132	226	0		368	1	471	67			11	550	8,222
	1994	73	1,443	4,196	218	92	6,022	556		556	-	-	4	5	176	138	11		334	+	326	35			17	378	7,290
	1995	58	970	5,337	139	86	6,590	307		307	-	-	4	5	67	110	6		192	+	543	52			14	609	7,698
	1996	39	703	3,791	25	88	4,646	429		429	-	-	3	8	30	188	6	-	235	1	418	53			20	492	5,802
	1997	34	813	3,523	61	68	4,499	1,017		1,017	-	-	3	9	33	351	0	-	396	1	352	37			21	411	6,323
	1998	34	1,092	3,761	123	147	5,157	635		635	-	-	6	16	19	304	0	-	345	+	378	26			23	427	6,564
	1999	28	1,126	3,163	66	90	4,473	433		433	-	-	5	8	26	197	0	-	236	1	364	27			12	404	5,546
	2000	41	1,062	2,269	165	91	3,628	536		536	-	-	6	18	29	315	1	-	369		200	15			10	225	4,758
	2001	51	1,077	2,322	150	36	3,636	253		253	-	-	5	16	30	250	0	-	301		351	44			+	395	4,585
	2002	80	1,264	1,565	182	28	3,119	187		187	-	-	8	15	6	477	0	-	506	+	226	30			+	256	4,068
	2003	41	1,064	1,858	135	27	3,125	205		205	-	-	5	27	11	922	+	-	965	+	538	29			+	567	4,862
	2004	23	1,339	1,701	33	34	3,130	75		75	-	-	5	10	7	522	2	-	546	2	376	31			+	409	4,160
	2005	28	1,214	1,231	35	35	2,543	136		136	-	-	9	9	5	783	9	-	815	+	511	20			+	531	4,025
	2006	30	1,190	1,162	33	32	2,447	55		55	-	-	-	30	117	741	+	-	888	+	611	21			+	632	4,022
	2007	21	970	1,171	20	38	2,220	46		46	-	-	-	29	141	301	0	-	471		276	13			+	289	3,026
	2008	26	1,302	1,009	43	28	2,408	29		29	-	-	-	43	168	270	2	-	483		427	14				441	3,361
	2009	17	821	809	34	39	1,720	22		22	-	-	-	46	92	262	0	-	400		258	10				268	2,410
	2010	20	913	1,061	26	36	2,056	18		18	-	-	-	42	131	253	3	-	429		165	19				184	2,687
	2011	30	347	1,306	32	26	1,741	48		48	-	-	1	27	95	343	4	0	470		362	16				378	2,637
	2012	52	597	1,336	33	34	2,052	33		33	-	-	+	34	114	443	1	+	592		282	11				293	2,970
	2013	39	336	1,496	19	34	1,924	65		65	-	-	+	24	197	372	+	+	593		398	8				406	2,988
	2014	35	173	1,155	0	22	1,385	82		82	-	-	+	5	64	140	+	1	210		426	12			1	439	2,116
	2015	37	287	1,441	37	27	1,829	44		44	-	-	1	4	28	228	+	-	261		493	11	0			504	2,638
	2016	25	308	1,056	41	32	1,462	61		61	-	-	-	3	21	214	+	1	239	+	390	12				402	2,164
	2017	28	241	977	23	28	1,297	81		81			+	7	41	389	-	-	437		406	6				413	2,227
	2018	28	278	886	52	36	1,280	70		70			+	5	27	330	-	+	362		465	12				477	2,188
	2019	29	241	1,140	61	39	1,510	48		48			-	8	26	373	-	+	407		545	13		1		559	2,524
	2020	37	155	1,097	32	25	1,346	60		60			+	9	25	353	-	-	387		380	10				390	2,182
	2021	31	95	687	60	17	890	66		66			+	9	23	270	+	-	302		279	8				287	1,545
	2022	27	138	516	71	23	775	66		66			+	30	32	298	3	+	363		321	9		1		331	1,535
	2023	33	77	613	37	17	777	90		90			1	23	32	483	2	+	541	+	222	6				228	1,636
	2024	33	77	909	37	17	1,073	63		63			1	23	32	597	2	-	655	+	626	16				642	2,433
Retain catch total		5,206	81,937	325,661	45,453	6,661	464,918	6,727		6,727	0	0	93	986	5,379	26,878	2,974	2	36,312	8	14,667	926	0	2	1,484	17,087	523,773
Release	2010																							1		1	1
	2011																							0		0	0
	2016								+	+								1	1								1
	2018							+	2	2								0	0								2
	2019																	1	1								1
	2020																	+	+								+
	2021							0		0																	0
	2022							0		0								+	+								+
	2023								0	0								+	+								+
	2024								+	+								1	1								1
Release total								+	2	2								3	3					1		1	6
Total		5,206	81,937	325,661	45,453	6,661	464,918	6,727	2	6,729	0	0	93	986	5,379	26,878	2,974	5	36,315	8	14,667	926	0	3	1,484	17,088	523,779

Table 22-5 Annual retained and released catches (metric tonnes, whole weight) of Pacific blue marlin (*Makaira nigricans*) by ISC members fishery in the North Pacific Ocean, north of the equator 1953-2024. "0" - Fishing effort was reported but no catch; "+" - Below 499kg catch; "-" - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

		JPN		KOR			MEX		TWN							USA						
Catch disposition	Year	Longline	JPN Total	Longline	Purse seine	KOR Total	Sport	MEX Total	Set-net	Gill-net (not specified)	Harpoon	Longline	Others	Purse seine	TWN Total	Handline	Longline	Troll	Others	Purse seine	USA Total	Total
Retain	1953											-			-							0
	1954											-			-							0
	1955											-			-							0
	1956											-			-							0
	1957											-			-							0
	1958											887			887							887
	1959											781			781							781
	1960											948			948							948
	1961											703			703							703
	1962											628			628							628
	1963											691			691							691
	1964											934			934							934
	1965											1,016			1,016							1,016
	1966											957			957							957
	1967								-	-	317	898	167		1,382							1,382
	1968								-	30	649	1,433	120		2,232							2,232
	1969								-	58	465	1,232	103		1,858							1,858
	1970								1	21	604	1,385	70		2,081							2,081
	1971	5,461	5,461	0		0			-	13	473	1,331	118		1,935							7,396
	1972	6,772	6,772	0		0			-	14	490	1,205	50		1,759							8,531
	1973	6,453	6,453	0		0			-	12	275	1,650	265		2,202							8,655
	1974	6,545	6,545	0		0			1	6	355	2,144	146		2,652							9,197
	1975	4,374	4,374	0		0			-	3	421	2,638	207		3,269							7,643
	1976	5,018	5,018	0		0			-	9	511	1,315	162		1,997							7,015
	1977	4,780	4,780	0		0			-	11	391	1,183	110		1,695							6,475
	1978	5,900	5,900	0		0			1	15	364	1,633	7		2,020							7,920
	1979	5,949	5,949	0		0			3	19	362	1,646	164		2,194							8,143
	1980	5,613	5,613	155		155			-	35	444	1,185	170		1,834							7,602
	1981	5,518	5,518	0		0			-	35	313	1,840	69		2,257							7,775
	1982	6,051	6,051	351		351			-	7	306	2,139	120		2,572							8,974
	1983	4,796	4,796	82		82			-	26	741	2,122	127		3,016							7,894
	1984	6,248	6,248	155		155			-	22	960	1,789	111		2,882							9,285
	1985	5,164	5,164	45		45			9	11	747	1,187	43		1,997			145			145	7,351
	1986	5,922	5,922	86		86			4	90	839	1,723	107		2,763			220			220	8,991
	1987	5,370	5,370	89		89			12	9	973	4,627	1		5,622		51	261			312	11,393
	1988	5,054	5,054	133		133			20	8	658	2,822	589		4,097		102	266			368	9,652
	1989	5,117	5,117	50		50			10	14	640	2,691	9		3,364		356	326			682	9,213
	1990	4,116	4,116	44		44	-	-	3	24	427	1,749	143		2,346		378	295			673	7,179
	1991	4,094	4,094	75		75	-	-	4	50	338	2,288	152		2,832		297	346			643	7,644
	1992	3,721	3,721	60		60	-	-	25	40	432	3,786	110		4,393		347	260			607	8,781
	1993	4,600	4,600	36		36	-	-	44	41	400	4,135	82		4,702		339	311			650	9,988
	1994	5,832	5,832	2		2	-	-	12	30	206	3,007	7		3,262		362	298			660	9,756
	1995	5,907	5,907	0		0	-	-	15	36	895	3,896	5		4,847		570	315			885	11,639
	1996	3,260	3,260	10		10	-	-	13	35	270	3,337	10	-	3,665		467	409			876	7,811
	1997	3,697	3,697	145		145	-	-	5	48	194	3,683	-	-	3,930		487	378			865	8,637
	1998	3,438	3,438	335		335	-	-	8	59	91	3,624	1	-	3,783		395	242			637	8,193
	1999	3,751	3,751	164		164	-	-	21	32	135	3,417	-	-	3,605		357	293			650	8,170
	2000	3,606	3,606	96		96	-	-	24	40	186	4,131	2	-	4,383		314	235			549	8,634
	2001	3,594	3,594	166		166	-	-	18	57	229	4,733	-	-	5,037		399	291			690	9,487
	2002	2,976	2,976	152		152	-	-	13	63	32	4,448	6	-	4,562		264	225	1		490	8,180
	2003	2,836	2,836	158		158	-	-	20	107	52	7,685	4	-	7,868		363	210			573	11,435
	2004	2,977	2,977	226		226	-	-	14	93	36	6,672	9	-	6,824		283	188	5		476	10,503
	2005	2,506	2,506	303		303	-	-	8	65	48	7,630	16	-	7,767		337	187			524	11,100
	2006	2,414	2,414	217		217	-	-	12	15	30	5,729	-	-	5,786		409	160			569	8,986
	2007	2,016	2,016	120		120	-	-	3	17	20	5,117	+	-	5,157	1	262	127			390	7,683
	2008	2,096	2,096	219		219	-	-	10	16	15	5,477	1	-	5,519	1	349	198			548	8,382
	2009	1,840	1,840	224		224	-	-	9	12	9	4,638	1	-	4,669	1	360	15			376	7,109
	2010	2,457	2,457	257		257	-	-	5	27	15	4,959	1	-	5,007	2	306	148			456	8,177
	2011	2,343	2,343	684		684	-	-	3	18	17	4,625	9	2	4,674	2	373	199			574	8,275
	2012	2,019	2,019	587		587	-	-	6	13	16	4,097	+	12	4,144	2	298	141			441	7,191
	2013	2,179	2,179	963		963	-	-	2	6	16	4,607	+	9	4,640	3	406	137			546	8,328
	2014	1,903	1,903	801		801	-	-	4	11	124	4,861	5	7	5,012	4	535	159		1	699	8,415
	2015	1,622	1,622	531		531	-	-	3	14	177	4,306	+	3	4,503	3	631	196			830	7,486
	2016	1,581	1,581	1,116	+	1,116	-	-	3	23	158	3,398	3	4	3,589	2	562	163			728	7,014
	2017	1,414	1,414	1,453		1,453			-	7	138	3,977	+	6	4,128	3	687	155		3	849	7,844
	2018	1,271	1,271	1,336		1,336			-	11	108	3,501	-	10	3,630	3	664	166		2	835	7,072
	2019	1,245	1,245	981		981			-	22	99	3,359	+	4	3,484	5	901	176		3	1,085	6,795
	2020	834	834	673		673			2	30	115	1,955	+	-	2,102	3	618	111		3	735	4,344
	2021	801	801	678		678			2	30	107	2,098	1	1	2,239	3	444	128		2	576	4,294
	2022	816	816	520		520			2	80	128	2,246	9	+	2,465	3	517	117		1	638	4,439
	2023	986	986	868		868			2	37	75	2,298	1	2	2,415	3	392	94		2	490	4,759
	2024	1,446	1,446	997		997			2	37	75	3,345	1	3	3,463	4	712	132		2	850	6,756
Retain catch total		197,386	197,386	15,346	0	15,346	0	0	376	1,720	17,689	188,819	3,621	60	212,285	44	14,906	8,291	6	17	23,264	448,280
Release	2010																			1	1	1
	2011																			6	6	6
	2012																					
	2013													5	5							5
	2014																					
	2015				+	+								3	3							3
	2016				1	1								4	4							5
	2017													6	6							6
	2018			1	1	2								6	6							8
	2019			+		+								5	5							5
	2020			0		0								5	5							5
	2021			+		+								2	2							2
	2022			+	2	2								3	3							5
	2023			2	4	6								6	6							12
	2024			1	2	3								3	3							6
Release total				3	8	11								48	48					7	7	69
Total		197,386	197,386	15,349	8	15,357	0	0	376	1,720	17,689	188,819	3,621	108	212,333	44	14,906	8,291	6	24	23,271	448,349

Table 22-6 Retained and released catches (metric tonnes, whole weight) of blue sharks (*Prionace glauca*) by ISC members fishery in the North Pacific Ocean, north of the equator, 1985-2024. “0” - Fishing effort was reported but no catch; “+” - Below 499kg catch; “-“ - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN						KOR			MEX		TWN		USA							Total
		Set-net	Drift gill-net	Longline	Others	Not specified	JPN Total	Longline	Purse seine	KOR Total	Others	MEX Total	Longline	TWN Total	GND	LLD	LTR	LX	MIS	RG	USA Total	
Retain	1985														-						1	1
	1986														1						2	2
	1987														1						2	2
	1988														-						3	3
	1989																				6	6
	1990														-						20	20
	1991														-						1	1
	1992														1						2	2
	1993														-						0	0
	1994	15	582	35,437	18	4	36,055								-						12	36,067
	1995	12	487	34,246	10	4	34,759								-						5	34,764
	1996	11	478	28,054	18	4	28,564								-						0	28,564
	1997	14	603	29,582	7	6	30,212								-						0	30,212
	1998	12	616	29,863	5	4	30,499								-						1	30,500
	1999	12	834	32,816	6	2	33,671								-						0	33,671
	2000	12	736	30,497	10	1	31,257								-						0	31,257
	2001	12	737	32,380	9	2	33,140				-	-									0	33,140
	2002	11	768	28,465	13	1	29,258				-	-									0	29,258
	2003	11	1,350	25,631	12	2	27,006				-	-			-						0	27,006
	2004	12	1,202	23,910	7	3	25,135				-	-									0	25,135
	2005	+	1,321	24,307	13	2	25,643				2,721	2,721									0	28,364
	2006	5	1,204	21,363	2	2	22,576				2,765	2,765									0	25,341
	2007	5	1,323	18,655	19	2	20,004				3,324	3,324			9	8					17	23,345
	2008	+	944	15,374	14	1	16,333				4,355	4,355				7					7	20,695
	2009	+	1,208	15,889	4	1	17,102				4,423	4,423	11,541	11,541	1	9					11	33,077
	2010	4	962	16,504	9	1	17,481				4,469	4,469	7,670	7,670	-	7					7	29,627
	2011	12	771	8,566	1	3	9,353				3,719	3,719	13,117	13,117		13					13	26,202
	2012	2	1,085	10,463	3	3	11,555				4,108	4,108	10,606	10,606		16					16	26,285
	2013	6	1,103	11,860	4	2	12,976	75		75	4,494	4,494	6,321	6,321		1	0				1	23,867
	2014	4	1,060	12,361	0	2	13,426	100		100	5,502	5,502	8,151	8,151		0	-			-	0	27,179
	2015	21	697	10,500	+	2	11,220	53		53			8,551	8,551						-	0	19,824
	2016	26	1,832	9,507	1	2	11,367						8,563	8,563		0				0	0	19,930
	2017	4	1,366	9,795	+	1	11,166	8		8			11,121	11,121						+	1	22,296
	2018	40	1,236	9,111	0	1	10,388	4		4			11,761	11,761					3	+	3	22,156
	2019	35	1,149	8,448	0	1	9,633	4		4			18,165	18,165		+			14	+	15	27,816
	2020	59	1,119	7,072	1	2	8,253	0		0			15,566	15,566		0			3	0	3	23,822
	2021	25	1,484	7,774	1	1	9,285	2		2			8,835	8,835					2	0	2	18,124
	2022	27	1,063	6,901	0	1	7,992	0		0			12,871	12,871				0	3	0	3	20,866
	2023	31	1,058	8,484	1	1	9,576						22,306	22,306					2	0	3	31,884
	2024	31	1,058	8,484	1	1	9,576						26,462	26,462					1	1	2	36,039
Retain catch total		438	30,381	562,216	187	65	593,287	246		246	39880	39880	175,049	175,049	13	61	0	0	81	2	157	808,619
Release	2015							0		0												0
	2016							8		8												8
	2017							11		11												11
	2018							58		58												58
	2019							12		12												12
	2020							22		22												22
	2021							20		20												20
	2022							33		33												33
	2023							36	0	36												36
	2024							56	+	56												56
Release catch total								202	0	202												202
Total		409	29,319	555,322	187	64	585,302	447	0	447	39,880	39,880	175,049	175,049	13	61	0	0	81	2	157	808,816

Table 22-7 Retained and released catches (metric tonnes, whole weight) of shortfin mako sharks (*Isurus oxyrhinchus*) by ISC members fishery in the North Pacific Ocean, north of the equator, 1985-2024. “0” - Fishing effort was reported but no catch; “+” - Below 499kg catch; “-“ - Unreported catch or catch information not available. * - Data from the most recent years are provisional.

Catch disposition	Year	JPN Drift gill-net	JPN Longline	JPN Others	JPN Total	KOR Longline	KOR Purse seine	KOR Total	MEX Others	MEX Total	TWN Longline	TWN Purse seine	TWN Total	USA Drift gill-net	USA Harpoon	USA Handline	USA Longline	USA Troll	USA Hook and line	USA Others	USA Purse-seine	USA Sport	USA Total	Total
Retain	1985								43	43				129	1					19			149	192
	1986								84	84				250	1					59			310	394
	1987								197	197				208	3					188			399	596
	1988								248	248				106	3					214			323	571
	1989								135	135				117	1					137			255	390
	1990								288	288				229	3					141			373	661
	1991								228	228				125	1					91			217	445
	1992								376	376				118	3					19			140	516
	1993								442	442				87	1					32			120	562
	1994	123	748	18	889				336	336				80	1					46			127	1,352
	1995	103	985	13	1,102				333	333				79	1					14			94	1,529
	1996	101	1,152	14	1,267				413	413				85	1					9			95	1,775
	1997	127	877	15	1,020				401	401				118	3					11			132	1,553
	1998	130	667	12	809				386	386				85	1					12			98	1,293
	1999	176	1,051	13	1,241				439	439				52	0					9			61	1,741
	2000	156	1,020	14	1,189				539	539				64	+					12			12	1,804
	2001	156	1,132	14	1,301				491	491				30	1					10			41	1,833
	2002	122	803	5	930				488	488				69	+					12			81	1,499
	2003	229	849	6	1,083				471	471				57	+					9			66	1,620
	2004	134	920	1	1,054				865	865				38	1					13			52	1,971
	2005	155	938	43	1,135				609	609				25	1					8			34	1,778
	2006	178	996	6	1,180				641	641				38	+					7			45	1,866
	2007	244	1,041	15	1,299				689	689				37	+					6			43	2,031
	2008	212	968	14	1,194	-		-	609	609				27	1					5			33	1,836
	2009	294	1,201	1	1,496	-		-	653	653	78		78	21	1			0		7			29	2,256
	2010	272	917	20	1,208	-		-	760	760	54		54	10	0					10			20	2,042
	2011	163	648	11	823	-		-	758	758	208		208	8	0					8			16	1,805
	2012	229	716	2	948	-		-	715	715	74		74	9	0			0		11			20	1,757
	2013	345	700	9	1,054	8		8	711	711	107		107	16	0					12			28	1,908
	2014	263	784	3	1,051	8		8	-	-	119		119	7	0		53	+	3	6		9	78	1,256
	2015	334	553	11	898						322		322	7			58		1	4			71	1,291
	2016	446	1,020	16	1,481	+		+			220		220	12	0	1	70	+	1	4		+	89	1,790
	2017	271	702	10	983	+		+			187		187	13	+		71	+	1	5			89	1,260
	2018	223	862	28	1,114	+		+			265		265	11			60	+	1	5			78	1,456
	2019	214	883	3	1,100	0		0			273		273	7			47	0	1	20		0	74	1,448
	2020	194	549	16	759	0		0			247		247	3	1		16		1	3			23	1,029
	2021	133	473	23	629	0		0			196		196	5	0		5		1	2			13	838
	2022	161	618	41	820	0		0			161		161	2			2		1	2			7	988
	2023	142	718	17	877						205		205	6			2		1	6			14	1,096
	2024	142	718	17	877						193		193	5			2		2	4			12	1,082
Retain catch total		6,031	25,491	413	31,934	16		16	13,348	13,348	2,909		2,909	2,395	30	1	386	1	13	1,191		9	4,025	52,173
Release	2011																				0		0	0
	2012											-	-											-
	2016					1		1																1
	2018					1		1																1
	2019					1		1																1
	2020					1		1																1
	2021					+		+																+
	2022					+		+																+
	2024					+	+	+																
Release catch tota						3		3				-	-								0		0	3
Total		6,050	25,391	437	31,877	20		20	13,348	13,348	2,918	0	2,918	2,390	30	1	384	1	11	1,187	0	9	4,013	52,176

APPENDIX 1: OBSERVER STATEMENTS

Accountability.Fish

Day 1 Intervention:

Accountability.Fish is the only organization focusing solely on the transparency of processes that lead to RFMO decisions. Our global analysis shows that ISC remains an outlier in how it approaches civil society engagement in its scientific process, so much so that we consider ISC as the least transparent scientific body advising tuna RFMOs globally. The ISC's outputs shape management for species across the entire North Pacific. These are stocks that matter — not just to governments, but to fishing communities, consumers, retailers, and ecosystem health. And yet, the critical scientific work behind their management happens behind closed doors where Publicly-funded scientists meet in "working groups" — with no civil society participation — to provide foundational inputs of global fisheries management. This is a process with which civil society representatives can interact (in part of whole) in every other global venue—and largely in real time.

These Other bodies, including some you provide advice to — ICCAT, IOTC, IATTC, WCPFC, SPRFMO — allow observers into their various scientific processes. They consistently provide documents to civil society and permit questions, comments, even expert presentations. The ISC systematically has not allowed this in your working groups. This isn't about disrupting science. It's about protecting its credibility. Scientific advice that shapes public policy cannot remain locked away from the public. A process that excludes civil society — especially when it governs shared, high-stakes resources — is not neutral. It is political. Secrecy is inherently a political choice.

Moreover, there is ample peer-reviewed literature to support sustainability outcomes improve in scientific process when civil society participates. There is only belief to contradict this, not fact—measurable outcomes are well established in transparency literature. Additionally, I would like to state that Accountability.Fish supports what the chair categorized during today's Chair's Report as ISC's movement toward Open Science. As you all know, the three pillars of Open Science are Transparency, Sharing, and Inclusivity. Practitioners of Open Science endorse the sentiment that "Science works best in the Open." It is heartening to hear from the shark working group report that there is utility in engaging fishers to ground truth models—and that more such conversations would be useful and informative. This is an important step toward Open Science, but I urge ISC working groups to move swiftly in this transition toward inclusivity of accredited observers. Research shows it adds value. International governance norms show it is best practice. The status quo is increasingly indefensible.

Day 2 Intervention:

Yesterday, because of the robust response to Accountability.Fish's statement on ISC's procedures in engaging observers, I spent some time speaking with our treaty attorney and rereading our research on the topic, and I still come to the conclusion that ISC has numerous foundational issues in its approach to participatory observation that render ISC irregular when compared against multilateral governance norms.

Because Accountability.Fish is the only group focused solely on creating more civil society engagement in ocean governance processes, we are only here to aide ISC in modernizing its practices. I am not here to offer expertise on fisheries models, but to help in creating enabling conditions to produce better outcomes for oceans and the communities who depend on them—which governance literature shows improve with systematic civil society participation.

Let me address some of the theoretical and functional irregularities facing ISC vis-à-vis global multilateral norms—this isn't exhaustive but illustrates some of the structural outdatedness of some of ISC's procedures.

- ISC rules of procedure have a narrow definition of observer compared to WCPFC/IATTC, only acknowledging two categories, not including IGOs, for example.
- ISC rules state that documents from observers will not be distributed at the ISC Plenary; I have not seen this elsewhere and is counter to best practices.
- ISC has no accreditation process for observers—this is always a formal or informal process in international ocean governance and makes attending plenary and subsidiary meetings more straight-forward—subsidiary meetings rarely, if ever, have a different standard than the plenary.
- ISC does not charge an observer fee—you are entitled to impose a reasonable fee.
- In this Plenary, and potentially in working groups, there is no meaningful participation by observers. In all RFMOs, chairs have the ability to engage observers, seeking input throughout the meeting, including asking questions, adding expertise, or advocacy. ISC rules of procedure do not allow for this.
- In the ISC Rules of Procedure in the subheading entitled "invited experts", ISC's starting point is one of impediment and not access. The construct of invitation is the initial problem. True participatory observation does not require invitation it should provide predictability for observers. The use of consensus of members to approve outside participation is a proven way to stave participation, as is the requirement for members to nominate observers, as is the irregular and unduly burdensome 90 days required which is more than 2x the standard international timeframe.
- There are additional issues, especially as it concerns variation from WCPFC and IATTC which are both considerably more open as a baseline.
- Lastly and based on the discussion on item 14 the ISC Review,

Accountability.Fish is willing to offer ISC a review of its transparency procedure, including a peer-reviewed report at no cost to ISC or its members.

Monterey Bay Aquarium

Monterey Bay Aquarium would like to thank the ISC Chair and Delegations for the opportunity to attend the Plenary Meeting and to provide comments. We would especially like to thank our host, Korea, for organizing a terrific meeting and social events. Similar to previous years, we would like to acknowledge all the work done by the working groups to provide precautionary scientific advice to managers and note the positive conservation impact this has had for many stocks. Particularly, we would like to commend the Bluefin and Albacore working groups for their completion of their respective MSEs and candidate harvest strategies.

Given all the hard work done by ISC scientists on these fronts, I urge the national delegations and ISC scientists to do what they can to push the Northern Committee and Joint Working Group for adoption of final harvest strategies for both these important stocks. Given the extended back and forth between scientists and managers, we feel a clearer understanding of the respective roles of managers and scientists would aid this process. From our experience at ICCAT, where similar problems existed in the past, a series of manager/scientist dialogues was helpful in codifying roles and responsibilities (deciding on acceptable risk, prioritizing tradeoffs, etc.) for the respective bodies. We feel a similar series of dialogues would also be helpful for the ISC and Northern Committee and could smooth adoption of harvest strategies and other measures deriving from the work done by the ISC.

To improve data reporting and compliance, the ISC should encourage the Northern Committee, WCPFC, and its representative states to adopt greater observer (human and electronic) coverage in chronically unobserved and under observed fisheries, particularly those operating on the high seas. Sufficient and accurate data underpins all the work done by the ISC, and increasing reporting, especially for non-target species, is the first step in achieving and maintaining sustainable fisheries.

Lastly, Monterey Bay Aquarium calls on the ISC to increase transparency throughout their operating process. This would include making it easier for outside experts to fully participate in working group discussions, increasing independent review of the working groups, and making non-confidential data available for review and use by outside scientists. We hope the ISC uses the upcoming external review process to develop new rules and procedures that increase transparency and participation by non-governmental scientists. Thank you for your time.

The Ocean Foundation

The Ocean Foundation would like to begin by thanking the Chair and all ISC members for the opportunity to attend the plenary as observers and offer comments. The Ocean Foundation also acknowledges the considerable amount of work undertaken by the various working groups.

On North Pacific Albacore, The Ocean Foundation commends the working group for their efforts to advise the Northern Committee (NC) on how to translate fishing intensity into actionable management terms. Considering the significant investment of time, resources, and technical expertise already dedicated to the Management Strategy Evaluation (MSE) process and the adoption of a management procedure (MP), reaching agreement on the translation and allocation of fishing intensity by IATTC and WCPFC represents the final—and critical—step toward implementation. Any further delay would undermine the substantial progress that's been made on both the MSE and MP adoption. While it is reassuring that the stock is currently above reference points, The Ocean Foundation emphasizes that we must ensure robust, legally binding, and implementable mechanisms are in place to be able to claim that there is a harvest strategy in place should the stock decline; establishing these measures now is necessary to avoid reactive management in the case of such an event. To facilitate the addition to the harvest strategy, the ISC could provide template text to make it clear what would need to be added to the IATTC and WCPFC measures to specify the fishing intensity conversion into total allowable catch (TAC) and/or total allowable effort (TAE).

On Pacific Bluefin Tuna, The Ocean Foundation commends the lead analyst and the PBFWG for the substantial undertaking of finalizing the MSE results. This milestone represents a major advancement toward precautionary, science-based management of a valuable and vulnerable stock. The Ocean Foundation encourages the continuation of this progress through the adoption of an MSE-tested MP at both the WCPFC and IATTC Commission meetings this year. The Ocean Foundation also commends the WG for providing stock assessment code via a public GitHub repository and for their intention to share the outputs of the finalized MSE via a public-facing Shiny App.

On North Pacific Swordfish, The Ocean Foundation thanks the BILLWG for their effort in evaluating the feasibility of conducting a NPO SWO MSE and for outlining a draft timeline of what such an effort would entail. The Ocean Foundation acknowledges that the working group does not have internal capacity to conduct the MSE, and encourages the BILLWG to make the need clear to the NC for financial support to hire an outside analyst in order to continue progress on its MSE initiative. This support could include outside funding from groups like ours.

On Open Science, The Ocean Foundation is encouraged by the ISC's growing commitment to improving transparency and progressing open science. We were pleased to hear about the open science training workshops that were held to build capacity among ISC members in areas such as version control and data sharing. The Ocean Foundation acknowledges the posting of assessment materials in public GitHub repositories available to stakeholders as a good first step towards open science at ISC. The Ocean Foundation encourages the ISC to continue offering and improving these training workshops and to consider extending participation to stakeholders. Furthermore, The Ocean Foundation recommends that any code and files relevant to MSEs of ISC stocks be also made available to stakeholders in public repositories for the sake of increased transparency. The Ocean Foundation notes that additional steps towards improving open science and transparency at the ISC would include timely posting of meeting documents and reports to the ISC website, opening technical meetings to stakeholders, and allowing observer interventions during the plenary when discussions are directly relevant, rather than making observers wait until the end of the day. These practices would strengthen the credibility, effectiveness, and inclusivity of ISC science, and are especially critical for technical meetings related to MSE efforts as open stakeholder involvement is a key component of the MSE process.

On the ISC Review, The Ocean Foundation supports the inclusion of ISC transparency and openness practices as a focus of the upcoming ISC review. This represents a significant step towards improving open science and transparency at the ISC and we commend ISC members for their decision.

The World Wide Fund for Nature-Japan (WWF)

WWF Japan was pleased to learn that the ISC has completed the MSE of the PBF as scheduled, and that the stock assessment peer review and response process for Pacific bluefin tuna and striped marlin is progressing, and that activities to increase transparency are being explored. As sustainable fisheries in the North Pacific are increasingly demanded, expectations for the ISC's contributions are growing. To meet these expectations, we recommend that the ISC reconfirm what data should be collected, particularly on bycatch and discards, and use electronic monitoring (EM) technology to quickly and accurately collect environmental and catch information to improve the accuracy of stock assessments and investigate the impacts of climate change.